The Chemical Age

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Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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The Laboratory in Industry

IN this issue special attention is given to the place of the laboratory in industry, to the principles on which a modern research laboratory should be organised, and to various types of laboratory and automatic apparatus in use in research and in works practice. Mr. Cecil Hollins, writing with first-hand authority on the subject, usefully sketches some of the main conditions to be observed in the design and construction of a modern research laboratory. But beyond this, he restates what cannot be reiterated too often—the essential need of continuous and concentrated research if our industries are to maintain progress. There are signs, unfortunately, that the impetus which the war gave to research in all directions is beginning to abate. The short-sighted manufacturer, when trade depression appears, is apt to retrench his expenditure on research, as if it were a luxury instead of a prime necessity, just as the short-sighted merchant, when orders become scarcer, thinks it economical to cut off 50 per cent. of his advertising appropriation, and so ensure a further diminution in his trade. It becomes, therefore, a duty to keep before all our industries the fundamental importance of research, if only as the safest of all insurance against retrogression and decay.

It has been said that "the best chemical work has been done in the worst laboratories," but, as Mr. Hollins wisely points out, this was not the result of the poverty of the equipment but of the enthusiasm which triumphed over it. It is good economy, where a laboratory is installed, to see that both its design and its equipment are of the best, and there never was a time when the choice of good materials and instruments was wider than it is to-day. What is true of the laboratory is also true of works. Automatic instruments are now available which dispense with rule of thumb, and ensure, with a minimum of trouble and labour, the highest standards of exactness. In chemical research accuracy, of course, is one of the indispensable conditions of good work, but it is scarcely less important, if wasteful production is to be avoided, in works operations. Avoidance of waste, the accurate functioning of every piece of plant, the profitable utilisation of every bit of energy expended all make for cheaper and better production and that, again, is the basis of commercial success. In short, scientific industries of every kind need to be run on scientific lines, and nowadays that is only possible by the employment of the best scientific and mechanical aids to accuracy and efficiency.

The Neglect of Salesmanship

SIR ALFRED MOND, M.P., who is rapidly becoming the Disraeli of British industry and commerce, tells us in one of his excellent addresses on industrial problems that "salesmanship must become an art." New methods must be employed, new ideas welcomed, new processes established. "In this country," he sums up, "we don't sell; we wait for somebody to buy." In that one picturesque sentence he states a policy which the ordinary man would require a Blue Book to expound. He bids manufacturer, trader, and every other type interested in trade escape from the bonds of tradition, habit, and all the rest of the conventions that kill initiative and imagination, and take their goods off the shelves and sell them to the people who need them all over the world.

In probably no industry is this advice more needed than in the chemical industry, because nowhere are people more afraid of doing what has never been done before. One finds on every hand almost a sacerdotal respect for tradition; privacy and secretiveness have become almost a religion; to change a century-old custom of trade is like trying to change the stars in their course; to get business by methods unknown to our grandparents approaches a moral lapse. It is most refreshing to have a commercial leader like Sir Alfred Mond descending upon these good old conservative trade traditions, and telling those who

observe them that they are out of date. Only this week we have had four inquiries from responsible American firms respecting new processes patented in this country recently. They watch for new opportunities like hawks and search current publications for every possible new starting point. Over here, a board of directors would consider for six months the problem of spending an extra guinea a year on a technical publication, one issue of which might save them from heavy loss or point the way to heavy gains. Some of them actively resent new ideas ; they are such a bother, so disturbing to comfortable minds. Why not go on as we have always done in the past ? The answer, as the condition of British trade shows, is that the country cannot afford the luxury. We must go forward or go back.

We are particularly glad that Sir Alfred Mond has emphasised the importance of salesmanship as an art. One of the greatest elements in commerce, it has been sadly neglected in the chemical industry. British goods are somehow expected to sell themselves ; the producers seem to disdain the duty of selling them ; to study the arts of salesmanship is to descend almost to the vulgar. Other nations have dropped this stupid attitude. It is as much their business to sell as it is to produce ; the one process, however good, fails without the other. Yet in the chemical industry, with all our organisations and technical institutions, there is no association of salesmen, no systematised study of salesmanship, no place for salesmanship in the multitude of papers read every winter, no lectures or courses of study which an ambitious salesman can attend to perfect his knowledge of his own business. The absence of all such provision is a reproach to chemical organisation in this country, which will not be removed until we have a strong association of salesmen such as those existing in the United States, Germany, and other competitive countries. Perhaps Sir Alfred Mond's words may produce a quiver among the dry bones. We certainly hope so.

Annual Reports of the S.C.I.

THE volume of Annual Reports, which has recently been issued by the Society of Chemical Industry, adds yet another significant chapter to the story of the immense progress which has been made in applied chemistry since the first volume was published nine years ago. We have on previous occasions expressed the opinion that these annual surveys of the principal developments which have occurred constitute probably one of the most valuable pieces of work which the Society undertakes, and it is gratifying to find that even though the pruning-knife may have had to be used in connection with the Society's expenditure, this particular publication has at least not suffered. Apart from the rôle which the Society plays in fathering this series of volumes it must not be forgotten that the preparation of the reports calls for a piece of real altruism on the part of the individual contributors. Only those who have undertaken the task can properly understand the amount of time and work which is involved in searching comparatively remote literature and in compiling a fairly continuous narrative from a host of disjointed facts. It speaks well, however, for chemistry that year after year the names of contributors reappear—a fact which indicates that the prospect of a stiff and unremunerative task is in no way a deterrent to those who have the interests of progress at heart.

The current volume deals with twenty-four distinct branches of applied chemistry which are compartmented in much the same way as in preceding volumes. It is, perhaps, invidious to select certain reports for mention, where all bear the mark of unusual thoroughness and of ability on the part of the contributors to select the things of general interest without indulging their own fancies. In particular, however, we are gratified to note the gradual growth in the amount of space allotted to the subject of " Plant and Machinery " —a section which started rather hesitatingly, but which is now worthy of that newly recognised field covered by the term chemical engineering. Mr. S. G. M. Ure has covered his ground admirably, and in a subject which is peculiarly liable to " poaching," he is to be congratulated on the manner in which he has kept clear of the rightful preserves of others. Some of the contributors have adopted the practice of drawing attention to the more important books on appropriate subjects which were published during the period to which the Reports relate. This is a practice which should be encouraged, for, after all, the main object of the Society's volume is to provide information which is supplementary to the standard works on technical chemistry.

Active Carbon or Silica Gel?

THE report which has lately been published by the research committee of the National Benzole Association is an example of thoroughness in the presentation of facts to which we are too little accustomed in this country. The report in reality forms an admirably produced text-book of some 250 pages, and the information it contains is not only almost exclusive but, coming as it does from acknowledged experts, it may be regarded as the most authentic as yet available on certain modern problems in connection with adsorption which have been a good deal in the technical eye of late. It will, of course, be readily understood that the matter of the use of solid adsorbents, such as silica gel and active carbon, for the removal of the constituents of benzol from gases is one of unusual complexity, and its greater importance to the benzol and associated industries was held to necessitate thorough investigation by a representative technical committee. Within the past year or so a good deal has been said about the available adsorbents, and between the statements of the advocates of specific materials it was a little bewildering to form an opinion of the true merits of the recognised substances. The National Benzole Association has, therefore, performed a highly useful service in determining to sift the matter for the benefit of its members and the producing industry in general.

In the first place, it must be emphasised that the work of the research committee is by no means completed, but already a good deal has been done in the way of determining the relative efficiency of various types of carbon and silica gel. As to the process as a whole, success or failure would appear to depend upon

the cost and working life of the adsorbent used, so that it is difficult to draw conclusions until the processes have been thoroughly tested for some time under working conditions. Certain advantages have been claimed for active carbon over silica gel—such as its higher adsorptive capacity and selectivity towards organic vapours; but from a study of the data given it has not been really possible to draw any definite conclusions as to what these advantages really amount to under benzol recovery conditions. For the purpose of their experiments the Benzol Research Committee selected samples of German carbon (as used in the Bayer process), of American coconut charcoal, and of ordinary commercial silica gel.

For detailed particulars of the results of the various comparative tests to which these materials were put we must refer our readers to the report, but it may be mentioned that, although the quantities of benzene retained by each sample varied considerably on a weight basis, no appreciable difference in the efficiency with which the adsorbent removed the benzene from the gaseous mixture was observed, the efficiency, in fact, being equal to 98 per cent. in each case. Although, therefore, active carbon shows a considerably higher adsorptive capacity for benzene than does silica gel under benzol recovery conditions calculated on the *weight* of the adsorbent, the quantities of benzene retained by the two materials for the same *volume* are very nearly the same. This is only one of many of the important points which emerge from the committee's work, and it would almost seem to bring the question down to a matter of the comparative costs per ton and comparative densities. In other words, the practical man would probably ask which of the two substances would work out the cheaper, say, per 1,000 gallons of benzol recovered?

Better Trade Figures

THE Board of Trade returns for March indicate a welcome increase of activity in chemical trade overseas. The volume of business is larger in all directions. Imports of chemicals, drugs, dyes and colours have increased over the corresponding month of 1924 to the value of £226,085; exports of United Kingdom chemical produce and manufacture have correspondingly increased by £158,516; while exports of foreign and colonial chemical merchandise—commonly known as re-exports—show a corresponding increase of £47,560. Not only are the figures all better than twelve months ago, but chemical imports and exports are both up on the figures for February. One of the most notable decreases in export is in ammonium compounds. Sulphate exports have fallen from £370,396 to £253,019. The heaviest decline is in the case of Japan, but there are also substantial decreases in exports to France and Dutch East Indies. Against these, however, must be placed an increase from £49,592 to £95,609 in the case of Spain and the Canaries. One of the largest individual increases is in crude glycerine—from £3,696 to £25,966. There is also a substantial increase in the export of coal tar dyestuffs, while the imports in nearly every class are appreciably lower.

Points from Our News Pages

Mr. Cecil Hollins, in his article on "The Design of a Chemical Research Laboratory," deals with the construction, equipment and management of the modern research laboratory, and offers practical points in the planning of the ideal building (p. 394).

A comprehensive survey is made of modern scientific instruments and laboratory furnishings. A wide range of apparatus is dealt with and practical advantages are outlined and frequently illustrated (p. 396).

Professor J. S. S. Brame, in his Howard Lecture on "Motor Fuels," reviews past progress and the possibilities of research and commercial enterprise in the future (p. 408).

A portrait appears of the late Mr. Walter Waugh (p. 409).

The death is announced of Mr. George Pilkington and Mr. Joshua Hacking (p. 411).

Our London Chemical Market reveals trade slowly reopening after the holiday. The export market is featureless (p. 416).

Our Scottish chemical report shows a quiet market in heavy chemicals and prices generally steady (p. 419).

Books Received

PHYSICAL CHEMISTRY. By James C. Philip. London: Edward Arnold and Co. Pp. 367. 8s. 6d.

PROFITABLE SCIENCE IN INDUSTRY. By D. T. Farnham, James A. Hall, R. W. King and H. E. Howe. London: Macmillan and Co., Ltd. Pp. 290. 15s.

THE CHEMISTS' YEAR BOOK, 1925. Edited by F. W. Atack. Manchester: Sherratt and Hughes. Pp. 1165. 21s.

The Calendar

1925 Apr. 27	Faraday Society: Papers by A. E. Ollard, H. Sutton, W. A. Naish, H. J. Poole, E. K. Rideal, D. B. Macleod. 8 p.m.	90, Great Russell Street, London, W.C.1.
27	Royal Society of Arts (Howard Lecture II): "Motor Fuels." Professor J. S. S. Brame. 8 p.m.	John Street, Adelphi, London.
27 & May 4	Royal Society of Arts. Howard Lectures: "Motor Fuels." Professor J. S. S. Brame.	John Street, Adelphi, London.
28	Institute of Metals (North-East Coast Section): Annual General Meeting. 7.30 p.m.	Armstrong College, Newcastle-on-Tyne.
30	Northampton Polytechnic Institute: "The Metallography and Heat Treatment of Iron and Steel"—Cast and Malleable Cast Iron. R. Genders. 7 p.m.	St. John Street, London, E.C.1.
May 1	Royal Institution: Crystalline Structure of Inorganic Salts. Professor W. L. Bragg. 9 p.m.	21, Albemarle Street, London.
1	Society of Chemical Industry (Manchester Section): "Recent Progress in Vitamin Research." Dr. S. S. Zilva. 7 p.m.	16, St. Mary's Parsonage, Manchester.
4	Royal Society of Arts (Howard Lecture III): "Motor Fuels." Professor J. S. S. Brame. 8 p.m.	John Street, Adelphi, London.
4	Society of Chemical Industry (London Section). 8 p.m.	Burlington House, Piccadilly, London.
4	Royal College of Science Association: "Thomas Henry Huxley." Professor E. B. Poulton. 5 p.m.	Exhibition Road, South Kensington.
4-8	Twenty-ninth Chemists' Exhibition.	Holland Park Hall, London, W.
6	Institute of Metals. Annual May Lecture: "The Motion of Electricity in Metals." Professor Dr. H. A. Lorentz. 8 p.m.	Institution of Mechanical Engineers, Storey's Gate, London, S.W.
6	Society of Public Analysts. 8 p.m.	Burlington House, Piccadilly, London.
7	West Yorkshire Metallurgical Society: "The Selection of Iron by Fracture and Chemical Analysis." 7.30 p.m.	George Hotel, Huddersfield.
7	Chemical Society. 8 p.m.	Burlington House, Piccadilly, London.

The Design of a Chemical Research Laboratory

Notes on Construction, Equipment and Management

By Cecil Hollins, B.Sc., A.I.C., F.C.S.

In the following article (which appears appropriately in an issue specially concerned with laboratory furnishing and scientific instruments) Mr. Hollins indicates some of the ideals that should be aimed at in the erection, equipment, and management of a modern chemical research laboratory.

THE movement towards industrial research, which began in the last year of the War and reached very considerable strength a little later, seems recently to have suffered a relapse, and a number of firms are asking themselves whether they are ever likely to see again the money they spent, and are spending, upon research. It is only natural that during a prolonged depression in trade the commercial economists should look with a hungry eye on the hard cash swallowed up in the maintenance of what most of them have always regarded as a luxury. Five years ago they were ready to squander a generous portion of their excess profits upon the new toy; but only a few of them took it really seriously, and it now becomes very difficult to convince them that research is a paying investment. Indeed, there are many instances where it never will pay, and no general case can be made out in favour of research except on an altruistic basis, which is hardly likely to appeal to the business man.

Continuous and Concentrated Research

On the other hand, continuous and concentrated research is essential to the life of certain industries, particularly those in which organic chemicals are manufactured, as for example in the dye-making, fine chemical, and perfumery industries. Here research is no luxury but a living part of the business. Products which are sold in competition with other firms must be produced in the best possible yield and of the best attainable quality. This can only be assured by spending money upon properly directed research. Equally important is the discovery of saleable novelties—either new products or new methods of manufacture—and for this purpose a research department is necessary. With other cogent arguments, national or individual, in favour of research we are not concerned in this article. The failure of research to justify itself to boards of directors in some cases, and its only moderate success in others, may be due to several causes, two of which are poor equipment and inefficient direction. It may be useful, therefore, to review briefly the teachings of experience during the last six years on these two points.

Victor Meyer is reported to have asserted that "the best chemical work has been done in the worst-equipped laboratories." This, of course, would be an exaggeration to-day, though thirty or forty years ago it was probably true. The best work was that of enthusiastic pioneers in practical chemistry, who had to work in make-shift laboratories, often under most discouraging conditions. The excellence of their results is due to their genius and enthusiasm, and they succeeded in spite of the poor laboratory equipment, not because of it. Such pioneers exist to-day, and the fortunate manufacturer who could staff his research department with them would never need to ask "Does research pay?" But the average research chemist is an average research chemist, not a pioneer, and if good work is required of him he must be provided with good tools and a good workshop.

The laboratory itself should be spacious, well-lighted and well-ventilated. A separate one-storey building is best, but if this is not feasible the laboratory should occupy the highest floor. Not only does this prevent inconvenience in the remaining offices due to unavoidable fumes and smells, but it allows of additional lighting from the roof. The walls should be light in colour in order to aid illumination; the best plan is to have the whole inner surface of white glazed bricks, which can be washed clean every week with damp cloths. The windows should be large, but if top-lighting is adopted it will be sufficient to have windows along one wall only, leaving three walls for shelving, special apparatus, etc. The size of the room is intimately connected with the question of ventilation and will depend, of course, upon the number of chemists intended to work in it.

There has been some diversity of opinion as to whether a number of small laboratories, each equipped for one chemist, is preferable to one or two larger laboratories, each accommodating half-a-dozen or more chemists. Experience has shown that the "water-tight compartment" plan is not a good one. A group of five chemists is of more value to a firm than five individual chemists. In both cases each may be doing individual work, but where there is close association and a free interchange of ideas all the results will be higher than the average level of ability amongst the five. Larger groups than five, or at most six, should be avoided. They are too heavy and cumbersome to promote that intimacy and freedom of intercourse which is both desirable and valuable; moreover, a laboratory to accommodate more than six chemists would have to be of unwieldy size.

Ventilation

Ventilation is an important and a very difficult matter. Draughts are obnoxious in a chemical laboratory, apart from the personal inconvenience they cause, but perfectly draughtless ventilation, in the rare cases in which it is attained, is more the result of fortunate accident then of preconceived design. It is possible, however, by suitable arrangements to reduce draughts to a negligible quantity. Details cannot be given here, but the most important point is to provide definite inlets and outlets for the air circulation and to exclude all adventitious entrance of air. The "plenum" system is now very generally disapproved.

Foul air should be extracted rather than diluted, and for this purpose exhausting fans may be installed, or, alternatively, the extraction may be performed by some really efficient "natural" ventilator such as the Boyle patent cowl. External air should be admitted by one or other of the various Tobin tube systems, by which it enters at a height of about five feet from the floor and is directed upwards. It is, perhaps, needless to emphasise that all windows should be made to open. A good plan is to have hoppers fitted in the *lower* part of the window. Much discomfort is caused by admitting large volumes of air through hoppers in the upper parts of windows. It is certainly directed upwards, but its velocity carries it across the ceiling and down the opposite wall, where it causes intolerable draughts.

For warming a chemical laboratory during cold weather nothing can take the place of steam radiators. These should be fixed, where possible, under windows and ventilation inlets.

The research laboratory, to be comfortable, should be lofty, and twenty feet is a moderate height for a laboratory of ordinary size. The floor space is also important—about 80 square feet per chemist is by no means too much. The floor itself, in the interests of cleanliness, is best made of some Bakelite material, which can be moulded up to the walls and benches so as to avoid sharp angles and facilitate sweeping.

Many types of bench are to be found in different research laboratories. The best is undoubtedly the simple flat-topped bench, free from every sort of permanent fixture on or above its surface. Generous bench-space must be provided for each chemist and a suitable size is about ten to twelve feet long by four-and-a-half feet wide and about two-and-a-half to three feet high. The bench top may be of hardwood or lead-covered, with a central channel draining into a sink at one end. Under the bench should be drawers and either cupboards or an open space (with a slightly raised floor) for the storing of apparatus in constant use.

Steam Supplies

One of the great advantages a works research laboratory has over others is a cheap supply of steam, and full use should be made of this. There should be a steam jet on every bench—steam distillations, steam jackets, and steam-baths for the evaporation or distillation of volatile liquids are only a few of the uses to which this can be put. It is a simple matter, where steam is available, to arrange for a good hot-water supply. The water, in a raised cistern, is heated by live steam and is supplied to the benches through ordinary pipes. A very convenient arrangement is the single hot and cold water

tap with a swan-neck bend sold by most laboratory furnishers. Separate valves control the hot and the cold water, and water can thus be delivered at any temperature from 15° to 90°. Branch taps may be fitted on both sides, giving a cold water supply for condensers, and a hot water supply for water-baths, hot funnels, etc.

The benches will, of course, require half-a-dozen or more gas taps and for research laboratories a good "vacuum supply" is a practical necessity. A rotary vacuum pump, worked by steam or electricity, exhausts the air from one of a pair of large reservoirs which are connected by pipe-lines to the vacuum jets on the benches. A pressure of from sixty to one hundred millimetres of mercury should be aimed at. This is sufficient for filtration by suction, which is the principal use for the bench vacuum. For distillations at lower pressures metal pumps of the Bunsen type should be fixed permanently to special water-taps, either on the side-benches only or also on the central benches. A Guericke pump for pressures of one or two millimetres is a luxury which may be justified in special cases.

A well-equipped research laboratory will also include a compressed air supply to each bench, though this is much less essential than the vacuum supply.

Fume-Cupboards

Fume-cupboards in the olden days used to be small dark closets hidden away in corners. In the modern laboratory they are roomy, glazed on all sides and most conveniently fitted against a large window instead of against a blank wall. The draught is produced by means of a powerful electrical fan. If the cupboard is used constantly for operations in which acid fumes are evolved, the fan will require frequent attention, but there are several protective devices which reduce corrosion to a minimum. If a hot chimney of sufficient draught is conveniently near, all fume cupboards may be connected with it by large pipes or tunnels, provided with regulators, so that the draught can be shut off from cupboards not in use.

A favourite device in American laboratories is to have several small hoods on each bench, all connected by pipes to a powerful fan or to a hot chimney. In England it is more usual to have one large hood for each laboratory, the draught being produced by means of a flame or a small Fletcher burner at the foot of the outlet tunnel. These are in addition to and not in place of the fume-cupboards (which are essential for experiments in which dangerous gases are evolved or used).

Essential Apparatus

The general apparatus used in research laboratories does not come within the scope of this article, but certain special pieces of apparatus may be mentioned here.

Drying-ovens must be provided. Of the many types available one of the best is the combined steam oven and distilled water apparatus which may be obtained from any of the leading dealers in laboratory equipment. The steam from the usual copper jacket is led through a tin spiral immersed in a cold water tank, where it is condensed and flows into the distilled water receiver. A constant level arrangement from the condenser to the copper jacket prevents the oven from boiling dry.

An electric drying-oven, with resistances so arranged that different temperatures may be obtained at will, is another convenience which can hardly be termed a luxury wherever current is available.

A very useful piece of equipment is the hot sand-bath. A large metal tray, about 6 ft. long and 3 ft. wide, is filled with fine sand to a depth of 1 or 2 in. and kept hot by means of steam pipes immediately underneath it. The insides of glass beakers, flasks, etc., can be dried in a few seconds by rinsing with the hot sand, and all the ordinary uses of a sand-bath are available in addition.

Electric hot plates are something of a luxury and offer few advantages over the sand-bath just described.

Every laboratory should be supplied with one or more blow-pipes. Separate small tables with lead-covered tops are obtainable with special blow-pipe fittings. Foot-bellows have their advantages, but for most work the air-blast is a great convenience, especially if the controlling tap be of the long lever type which can be adjusted easily with the little finger.

A piece of apparatus less frequently seen in research laboratories than its utility deserves is the centrifuge. These are made in several forms, the most generally useful being the flat disc-shaped variety. The amount of time saved in filtration by first using a centrifuge amply warrants the inclusion of this apparatus in the equipment of every organic laboratory.

No research laboratory is complete without provision for mechanical stirring. This is most conveniently arranged on a long side-bench; on the central benches it takes up valuable space and is less economical. Double or triple pulleys are fixed at 12 to 18 in. intervals along a driving shaft which is rotated by means of an electric motor. The motor should be placed on a special shelf well above the bench so as to be out of the way. It may be at either end of the shafting, but is most efficient when placed near the middle. The shafting and pulleys should be continued through into the draught-cupboards.

There are two or three good forms of mechanical shaking apparatus on the market, and these will be found necessary for certain chemical operations.

Balances

The balances form a very important part of the equipment of a research laboratory, and it is a mistake to try to make shift with any second-rate apparatus of this description. For rough weighings each laboratory should be provided with open scales of the "French pattern," and each bench with rough balances of the enclosed type weighing to a decigram. Accurate weighings for quantitative work require, however, special balances—Bunge, Sartorius, and Oertling are the best types—which must be housed in a separate room away from the fumes of the laboratory. The balance room should be fitted with slate slabs supported on brick pillars, built up from a solid foundation.

A separate room is also desirable for combustion furnaces, bomb furnaces, etc. These are best placed on fairly low stone benches. A considerable saving of time is effected by putting all carbon, hydrogen, and nitrogen combustions into the hands of one man. The work requires patience and a certain amount of skill, but for reliable and accurate results the main desideratum is continuous practice and experience. A semi-qualified man who devotes his whole time to combustions will get results which are much more reliable than those obtained by a chemist who only does a combustion now and then. It is really economical, therefore, to pay a man to do all the combustions for the department.

In the ideal research department special provision is made for experiments involving the use of noxious gases, such as phosgene, chlorine, sulphuretted hydrogen, etc. Such experiments should be performed in a separate laboratory fitted entirely with fume-cupboards having specially powerful draught fans. The usual gas, water, steam, vacuum and compressed air supplies will be needed, and also mechanical stirring gear. The gas taps and, if possible, all other taps should be placed outside the fume-cupboards and in front of them.

The writing of reports is as important a part of the research chemist's work as the experimental investigation. A writing-room should therefore be provided, either adjoining the laboratory or partitioned off from it. This should contain a separate desk (which may be quite simple and inexpensive) for each chemist, together with a few shelves for books.

Personnel and Organisation

If a research department is to be successful from the commercial point of view good accommodation and good equipment are necessary, but equally important are the personnel and organisation. The experience of the war years and the boom in research which followed have combined to create a very high standard of skill amongst the research chemists of to-day, and no firm should have any difficulty at the present time in getting together a thoroughly efficient staff of trained chemists, provided a fair remuneration is offered. It is much less easy to ensure that the activities of such a staff shall be profitably directed. It is the duty of a director of research to keep his staff supplied with problems for investigation, and for this purpose it is of first importance that he should be in intimate touch with the actual manufacturing side of the works. Regular and frequent conferences amongst heads of departments are a means to this end, and the sales department should indicate from time to time what products are in

demand or are likely to prove a profitable line in the near future. Suggestions for research will emanate frequently from the chemists themselves, and these should be carefully considered and criticised by the director before admitting them to the research programme. But in the main the director himself should be responsible for the ideas for research. A director also shows his value to the firm by knowing just when to abandon a given line of investigation. Chemical experimentation is so fascinating a pursuit that there is always a great temptation to the chemists to follow the numerous side paths which every research brings to view, and which are frequently of great academic interest, but rarely lead to anything of commercial value.

Finally, there must be an efficient mechanism by which valuable research results may be transferred to the works. Reports of improvements in existing processes should be studied by responsible persons in the departments concerned and tried out on the works scale at once. Novel products or processes are more suitably put through first on a semi-works scale with the assistance of the research chemist who has worked out the laboratory process.

Laboratory Furnishing and Scientific Instruments

What British Firms are Doing

We give below notices of various research and laboratory furnishings and requirements, etc., which British firms are now offering and which show convincingly the great developments in British production which have taken place within the last few years.

A Distance Reading Tank Gauge

A VERY simple gauge for indicating or recording at a distance the depth of liquid in a tank has recently been achieved by Negretti and Zambra, London.

The principle employed, as will be seen from Fig. 1, is

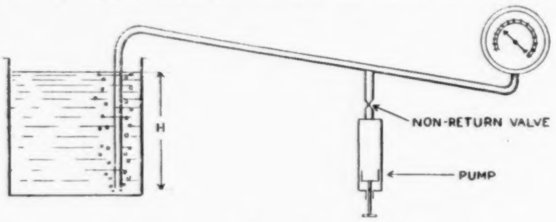


FIG. 1.

based on the maintenance of a true hydrostatic between the head of liquid to be measured and a low reading pressure gauge, the pressure being transmitted by air confined in a small connecting tube between the balance chamber or diving bell and the dial gauge. This principle, of course, is not new, but the advance which Negretti and Zambra claim to have made is the application of the dial pressure gauge for indicating low pressures. This has only been achieved by them after three years of experimental work and research, and with this low pressure reading gauge which they now produce they guarantee an accuracy of 99½ per cent.

In the usual pattern either one or two diaphragms are used with balanced parts and spring controlled levers are introduced to prevent overloading. Attention has been given to the bearings to minimise back-lash and friction to the smallest amount. Hysteresis is claimed to have been reduced to a minimum.

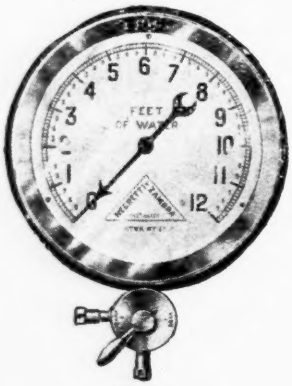


FIG. 2.

There is no doubt that a dial is much to be preferred to the liquid column on account of its legibility, compactness, ease of erection and length of service under adverse conditions.

The pointer travel on the standard gauge is approximately 20 in. (Fig. 2) and the dial can be divided to read any depth, volume, or weight. For accurate observation Negretti and Zambra recommend scaling for weight since this is not affected by temperature.

The air pressure required to maintain the true hydrostatic balance is provided by a small pump (Fig. 3), which may be fixed to a bracket at any convenient point.

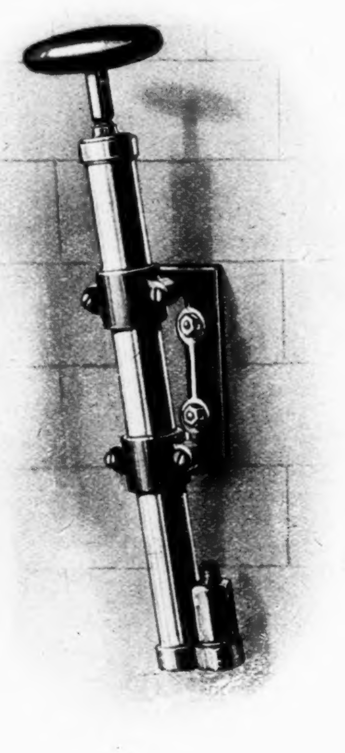


FIG. 3.

The pump is connected by a three-way cock to a diving bell (which is placed in the tank, of which the measurement is required) by a pipe of small bore; pressure created by this hand-pump overcomes the hydrostatic head of the liquid to be measured, and the pointer on the three-way cock is then turned to the gauge when the reading will be given upon the dial.

For viscous liquids, such as heavy oil, a length of 1 in. pipe is inserted between the diving bell and the main pipe to reduce risks of stoppage.

The dial or indicator can be fixed above or below the tank level and bends in the pipe have no effect upon it; neither do changes in temperature of the connecting pipe.

Where this is required to record on a chart the amount of liquid in depth, volume or weight, the hand-pump is dispensed

with and the air pressure obtained by means of compressed air. A small flow of air is allowed to pass through the diving bell continuously and is adjusted by means of a fine controlled needle valve. By this means a continuous record is obtained and any variations in the amount of liquid. An illustration of this recorder is given in Fig. 4.

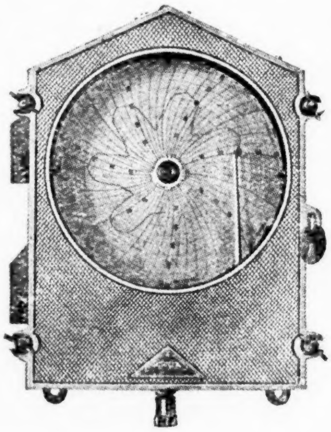


FIG. 4.

The "Oertling" Improved Torsion Balance

THE Eötvös Gravity Balance for the location of subterranean mineral deposits was originally designed as a visual reading instrument, the small torsional displacement of a mirror rigidly attached to the beam being observed by means of a telescope and scale as in the mirror galvanometer and similar instruments.

Whilst this method of visual observation is well suited to a laboratory apparatus, it has several drawbacks in a field instrument—especially in one which is preferably operated at night. It entails the provision of long brackets to carry the telescopes, which necessitates the employment of a bulky protecting tent about 6 ft. 6 in. square in plan, and as this tent must be double-walled and strongly constructed its weight is considerable, being some 4 or 5 cwt. Moreover, in order to read the instrument the observer must enter the tent at frequent intervals, thus allowing currents of air to penetrate and disturb the instrument, in addition to the disturbance caused by his own approach. He must also stay awake during the night in order to obtain the necessary number of readings. It was soon recognised that many, if not all, of these disadvantages could be eliminated by recording the displacement of the beam photographically, and various types of balances have been designed to effect this registration.

The new "Oertling" model has been designed with the special object of reducing labour to a minimum, and enabling the instrument to register its movements photographically —whilst it can also be operated visually if required without opening the protecting tent in either case. In the new design telescope arms are completely eliminated, the optical system being enclosed within the outer protecting wall which surrounds the upper torsion wires. The effective width of the instrument is thus reduced to less than 2 ft., and a special cylindrical metal tent of internal diameter only 2 ft. 6 in. has been designed to enclose the instrument completely, at the same time permitting all the necessary movements of recording to be performed. The rotation of the upper part of the instrument into the various azimuths is effected by a clockwork mechanism controlled by an electric time-clock, which also controls the illumination of the scales at proper intervals for the photographic record.

If the instrument is to be used visually, the dark slide containing the photographic plate is replaced by a ground glass screen and the illumination and rotation effected by the observer from without the tent which is not opened at all except during the preliminary adjustment of the balance.

An important feature is the optical system whereby a magnified image of the actual scale is thrown upon the ground glass screen for visual observation, or upon the sensitive plate for photographic recording. In all previous types of photographic balances the record merely consists of a spot of light of varying position, and the distance of this spot from the zero line has to be subsequently measured. With such registration visual reading is extremely difficult, but in the present design it is simpler than in a telescope, as the image of the scale can be viewed from a distance—in fact from outside the tent.

With this improved optical system, owing firstly to the increased effective distance of the beam mirror from the scale (80 c.m. compared with 60 c.m. in the telescopic instrument) and secondly, to the lens system which magnifies up to 5 times, the sensitivity of the reading is greatly increased and is variable at will. This permits the employment, if desired, of less sensitive torsion wires and thus eliminates much of the disturbing temperature and radiation effects.

With the additional protection against temperature and radiation effects arising from the provision of three metal walls to the instrument, and, if required, another three walls to the protecting metal tent—the spaces between all the walls being filled with thermally insulating material—it is claimed that in this new design temperature and radiation effects are reduced to an absolute minimum consistent with economical transport. It is confidently anticipated that readings can be taken both by day and night and at least three stations occupied every 24 hours; whilst, if desired, the instrument may be used visually by day and photographically by night. This will very greatly reduce the cost of a survey with the balance, especially where the interval between stations is small, as in mining areas.

The instrument and tent are made as far as possible in a special non-corrosive aluminium-alloy and are further protected by a coating of special paint. The total weight of the balance complete with battery and all accessories is approximately 140 lb. and of the tent about 200 lb. If desired, the instrument can be clamped rigidly inside the tent, and the two transported on a light trolley to the next station—thus avoiding the delay of dismantling and re-erecting both instrument and tent.

Bailey Metering Equipment

BAILEY metering equipment, manufactured in this country by Industrial Combustion Engineers, Ltd., Astor House, Aldwych, W.C.2, is rapidly becoming as well known in Europe as it is in the United States of America. Every detail of boiler operation can be indicated or recorded with Bailey apparatus and the following are brief descriptions of some of the more important apparatus.

Bailey boiler meters record and totalise steam flow and they record air flow, flue gas temperature, coal feed, etc., up to a total of four records on one chart. The steam flow record shows the rate of steam generation, whilst the air flow gives the air supplied for combustion. The relation of the steam and air flow records shows the combustion conditions, that is, whether the correct amount of air is being supplied for combustion. When maximum efficiency is being obtained the steam flow and air flow pens are together, quite regardless of the rate of steam output. Excess air is shown by the air flow pen being above the steam flow pen, whilst deficiency of air is shown by the air flow pen being below that of the steam flow.

The Flue Gas Temperature Recorder makes a record of the average temperature of all the flue gas leaving the heating surface. This gives a check on the condition of the heating surfaces and baffles, as the presence of scale, soot, or a defective baffle is reflected in an increase in temperature. The boiler attendant need have no special knowledge of combustion conditions or the causes of a rise or fall in CO_2 in the waste gases. His job is merely to keep the air flow line coincident with the steam flow line and only when this is done is the boiler generating at maximum efficiency.

Information of secondary importance is indicated by means of a multipointer gauge. This gauge is made with any number of pointers, from one to twelve. They have a 10 inch motion, very plainly marked illuminated scales, so that they can be

seen easily at a distance of 25 to 50 feet. This design is so convenient and so easily read that it has been developed to show draughts, pressures, temperatures, rate of flow, stoker speed and other factors, thus indicating in one instrument all the secondary operating conditions. Any desired combination of scales can be supplied—operating, in the case of the pressure recorders, over any given range.

The Bailey fluid meter, which is identical with the Bailey boiler meter except that it has no air flow mechanism, records and indicates steam flow at either high or low pressure, feed water, service water and other liquids. Pressure and temperature recorders can be supplied to record on the same chart with the flow if so desired. The capacity of the meter is readily changed by exchanging orifices and one meter can be used on several orifices, either by changing its location, or by having a suitable arrangement of change-over valves. Both the fluid meter and the boiler meter are accurate to 2 per cent. under standard conditions.

Bailey gravity recorders are notable in that the actual gravity of a continuous sample is recorded on a 12-inch circular chart in any desired units. It can be designed for any given range, such as 0·80 to 1·00 or even a smaller range, as 1·000 to 1·020, and reads directly in specific gravity, degrees Baume, degrees Twaddell, etc. The operation of the recorder depends upon the variation in weight of a displacer suspended in the liquid with the variation of the gravity of the liquid. The continuous record is accomplished by passing the liquid or a portion of it through the casing in which the displacer is suspended. The displacer is expansible and filled with the same liquid, or a liquid having the same coefficient of expansion as the liquid being tested. The displacer therefore expands with temperature changes just the right amount to give automatically the correct gravity at all times, regardless of pressure and temperature.

Other Bailey specialities are weir meters, temperature and pressure recorders, and differential pressure recorders. The latter instrument can be designed for ranges as small as 200th of an inch of water flow and flow pen motion of $4\frac{1}{4}$ inches on a 12-inch chart. It is used for the measurement of air and gases at very low velocities.

"The Hurrell Homogeniser"

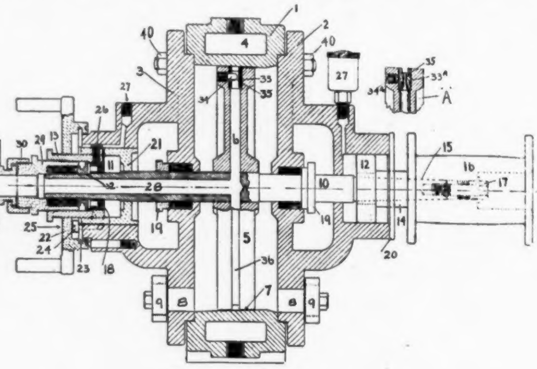
The constant widening of the field in which this machine has a useful application, has induced the makers, the Sun Lane Engineering Works, Blackheath, S.E.3, to add to the types suitable for special applications.

Of particular interest is an axial feed model. This was designed primarily for producing emulsions which froth greatly when air is allowed to be entrained. In this machine the suspensions, etc., are sucked from a level below the machine by the centrifugal pump effect of the liquid in the rotor enabling the treated materials to be discharged by gravity back to the suction or supply tank. In this way the machine works as a circulator permitting of repeated treatment. If the supply tank is of sufficient size, the mass of the materials ensures that they are cooled before re-entry to the machine, and at the same time sedimentation can come into play so that the larger particles of a suspension find their way to the lower part of the tank into which the suction pipe reaches. A uniform suspension can be obtained in this way without needlessly taking the already fine particles back to the machine.

There is now undergoing exhaustive tests at the works a very small size machine for strictly laboratory and experimental work, and it is anticipated that this summer will see this machine on the market. The smallest "Homogeniser" listed by the makers up to the present and which has been sold as a "laboratory" machine, has an output of such dimensions that it suffices for the manufacturing needs of a number of users; for example, up to 100 gallons per hour of cod liver oil emulsion is made by some firms, and long stretches of road have been bound by the cold application of bitumen emulsion made on a "laboratory" machine!

Although somewhat outside the chemical industry, this new small machine appears to fill a want in connection with the making of cream and whole milk from butter and milk powder, a process which while extensively adopted on the American continent, is little used in England—with one or two notable exceptions—the trouble being that the average confectioner deals in such small quantities, but with the advent of the diminutive machine just referred to it will be possible economically to manufacture as small a quantity as one gallon.

It is interesting to find that of the several metals—stainless steel, bronze, and Monel metal—of which the manufacturers



Model B X

are in the habit of constructing their machines or the interiors of them, Monel metal seems to be mostly adopted by manufacturers of foodstuffs and pharmaceutical products.

As is fairly well known, the Sun Lane Engineering Works maintain a demonstration plant at Blackheath, where firms interested in emulsifications, colloidal dispersions, and similar problems, may have tests carried out on their products.

Pulsometer Vacuum Pumps

Vacuum pumps now play such an important part in so many industries that it is easy to forget that a few years ago a pump which was able to produce a small quantity of ice in a watch glass was considered almost phenomenal. For many years past vacuum pumps capable of giving a far higher vacuum have been in regular use in laboratories. The improvement has not only extended to these hand pumps but to power-driven pumps of a large size suitable for manufacturing operations; consequently many operations formerly impossible on a commercial scale are now made quite easy. The purposes for which high vacuum is required are remarkably various, but one of the most important is to be found in the chemical trade where high vacua play a very important part in desiccation and distillation. Among other operations are the evacuation of wireless valves, incandescent electric lamps, etc.

Well-known workers in this field are the Pulsometer Engineering Co. of Reading and London, who manufacture vacuum pumps of practically any capacity and capable of producing vacua equal to those obtained by the small laboratory pumps. It is an undoubted advance to be able to obtain on a large scale a high vacuum measured in thousandths or ten-thousandths of a mm. The Pulsometer Company are pioneers of mechanical pumps for high vacua, and their R.L. type pumps are tested to a vacuum of better than one-hundred-thousandth of a mm. before dispatch and frequently one-millionth of a mm. is obtained on test.

In the chemical trade one of the most important pumps is the Geryk distillation and desiccation pump which is capable of evaporating at a low temperature and will carry on work considerably beyond that which is possible with the most efficient cold water condensing plant. The most refractory bodies readily yield up their vapours in the high vacuum produced, and results are obtainable which have not been possible hitherto. These pumps are made of a reciprocating or rotary type.

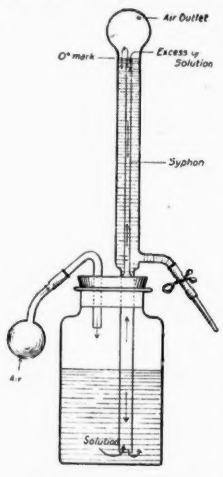
Another useful type of pump for use in the chemical trade is the Geryk condenser pump which, when used in conjunction with an efficient condenser, will give a vacuum of better than 1 mm. A special feature of these pumps is a unique attachment so that the pumps can be flushed through with oil whenever necessary without any trouble. There is practically no limit to the size of Geryk vacuum pumps and the largest pumps give the same degree of vacuum as the laboratory type; therefore operations requiring a high vacuum are now possible on a large scale.

Occasionally a small pump is required for experimental work and among the wide range of various types of Geryk pumps there is almost certain to be found one to suit the purpose desired. Recently the Pulsometer Co. designed a cheap form of pump which, whilst not designed for factory use, is sufficiently robust to stand a considerable amount of hard wear and is ideal for laboratory and similar work. Every Geryk pump has to maintain a high vacuum for at least 24 hours before it is dispatched. Occasionally there is a use for a high pressure pump and the Geryk patent pressure pump is capable of compressions up to 5,000 lb. per square inch; 3,000 lb. can be obtained with a single stage pump.

The Sofnol Syphon Burette

THE specialist has often to devise apparatus and to prepare chemicals necessary to his line of investigation. Apparatus and re-agents so devised are often of the greatest value, not only in their original application, but also in general laboratory work. For twenty years Sofnol, Ltd., of Greenwich, have specialised in the chemistry of water treatment. Much of this work has been of an analytical nature, and the apparatus and re-agents devised for the simple, rapid, and accurate examination of water, both before and after treatment, are in many cases of interest to the laboratory worker.

The accompanying diagram shows the Sofnol Syphon Burette. By the use of these burettes excessive handling of standardised solutions is avoided, while the solution standing in the burette is effectively protected from dust. The reservoir holds enough solution for a number of titrations, after each of which fresh solution may be pumped into the burette by actuating the hand-bulb. The solution then automatically sets to the zero mark.

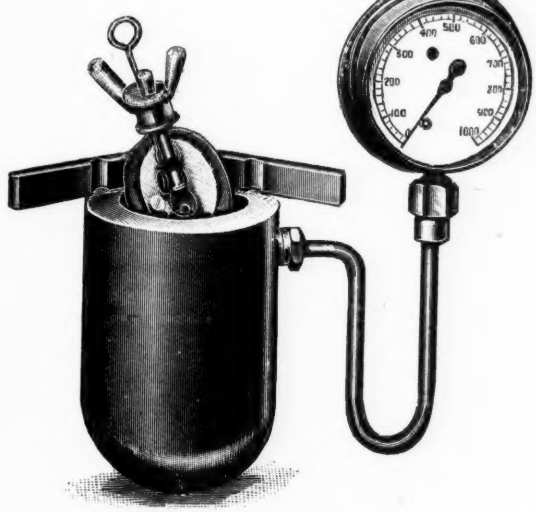


The usual acidimetric indicators, phenolphthalein and methyl orange, are not sufficiently sensitive for the titration of the dilute solutions used in water testing. Sofnol, Ltd., themselves prepare a range of indicators, including mixed indicators adjusted to the pH range needed for this work. They also manufacture special soap, both in solution and as a powder, for hardness estimations. Their whole range of apparatus and re-agents allows a remarkable combination of accuracy with the simplicity and rapidity so necessary in routine testing.

A recent development of the company's business in analytical re-agents has been the introduction of Sofnolite. This solid absorbent for the gravimetric estimation of CO_2 replaces potash solution and the use of fragile absorption apparatus. Comparative estimations of carbon, in pure organic compounds, show that equal, if not greater, accuracy is obtainable by the use of this solid absorbent, which has the further advantages of reasonable price and British manufacture. The firm's specialities are described in a series of attractive booklets, which have been noticed from time to time in THE CHEMICAL AGE. These booklets may be obtained gratis by any chemist applying to Sofnol, Ltd., Westcombe Hill, Greenwich, S.E.10.

Alembic Works Production

THANKS to the wider recognition of the importance of research laboratory equipment is a very different thing to-day from what it was even ten years ago. Among the firms who have worked to meet the increased demand for research and laboratory apparatus are Brown and Son, of the Alembic Works, Holloway, London. They now undertake the complete equipment of all forms of laboratory, industrial, medical research and educational, and are makers of every class of fitment and apparatus. They are manufacturers of physical and chemical apparatus to the L.C.C., contractors to the Government Laboratories and suppliers of laboratory sets to the Science and Art Department, South Kensington. Their specialities include steam and hot water copper jacketed ovens for bacteriological work, a patent combination water oven and still, and a newly designed autoclave. The last



1,000 ATMOSPHERE PATENT SELF-SEALING AUTOCLAVE.

item, a new pattern autoclave, is creating quite an amount of interest amongst laboratory workers owing to its ingenious, internally-fitted oval lid which makes quite easy the sealing of the lid against such pressures as 1,000 atmospheres.

Silica-Graphite Paint

PROBABLY nine out of ten so-called "failures" of protective coatings on gasholders, tanks, retorts and all iron and steelwork are due to improper application, and of those failures a large percentage is due to the fact that many paints are difficult to apply. This difficulty may be that the paint drags under the brush, resulting in great unevenness in the thickness of the coating, or it may be because of the heavy specific gravity of the pigment that "sagging" occurs. In order to avoid the latter fault the paint is brushed out so far as to make the coat exceedingly thin. Even with expert workmen these defects are decidedly a contributing cause of paint failures.

Neither of these objections is present in graphite paints. Anyone using a genuine graphite paint for the first time wonders at the ease and certainty with which it is applied. The surfaces are easily and quickly covered, and because of the low specific gravity of the pigment there is no "sagging." This ease of spreading is a direct result of the lubricating quality of the graphite itself, and is the explanation of the large volume of pigment which may be incorporated in a graphite paint. But a further addition is required to give the graphite the necessary endurance and resisting power to enable it to carry out its proper function. Silica acts for a graphite paint just as copper acts as an alloy to gold when the gold is to be manufactured in watch chains, rings, watch cases, or other articles subjected to wear.

Nature's mixture of flake silica-graphite, mined exclusively by the Joseph Dixon Crucible Co. at Ticonderoga, N.Y., affords a much superior paint film compared with a pigment where silica is mechanically added to the graphite. It is because of the oily nature and flake formation of the pigment that Dixon's silica-graphite paint acts as a natural protector in keeping away moisture, acids and gases from metal It is elastic. It gives with expansion, does not crack, peel, or flake off, and is proof against the effects of sun, rain and corrosive influence.

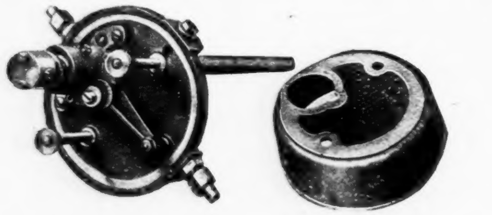
The manufacturers have never called Dixon's a "graphite" paint. Their product has always been designed as silica-graphite paint. Its natural colour is dark grey. In addition to this there is an olive green, dark red and black.

The firm recommend no lighter colours than these, as the addition of colouring pigments, other than those needed to produce the above colours, lessens the wearing qualities of graphite paint. The sole manufacturers in this country under special licence from the Joseph Dixon Crucible Co. are C. R. Averill and Co., 22, Duke Street, Stamford Street, Blackfriars, S.E., to whom inquiries may be addressed.

Arca Automatic Regulators

THESE regulators, which are already well known and widely used, employ a simple hydraulically operated relay, which enables them to be used for the accurate automatic control of almost any physical condition. The simplicity of the Arca system not only insures reliability, but permits a robust construction which enables these regulators to be used for the roughest factory conditions. They are far from being merely laboratory instruments and are manufactured in England. Several different types of relay are made. The chief of these is for high pressure, as of air and steam from 0 to 350 lb. per square inch; low pressure for control of gas, draught, etc., from +25" w.g. to −25" w.g.; temperature from 32° F. to 800° F.

Any of these relays can be used to operate a valve damper, or indeed any other mechanism to regulate the condition under control. The direct diaphragm-operated valve is at present made in sizes from ½ in. to 2½ in. bore for use with steam, air, water or gas, the body's valve and seat being of material suitable to the conditions. Larger valves and dampers are operated by a hydraulic cylinder controlled by a pilot valve connected to the relay.



Practically any problem where automatic control is of service to effect economy and improved products can be solved by the Arca Regulator, but the following simpler uses may be mentioned as specialities particularly where real accuracy and reliability are essential: Steam reducing and surplus valves, gas governors, furnace draught control, temperature regulators, especially for chemical operations of all descriptions, calorifiers and hot liquid vessels, and air conditioning plant controls.

Wood for Vats and Tanks

FROM time immemorial wood has been used for making vats and tanks for the storage or manufacture of liquids in various trades. Many still think there is nothing to compete with it for strength, resistance, and durability. It is also impervious to the fluctuations of temperature, and is cheaper than most other materials.

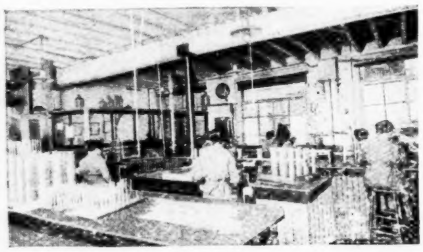
On the Continent, especially in Germany and Belgium, wood vats and tanks have been largely employed in the manufacture of all descriptions of chemicals and dyes for many years, and in America, in addition to the above purposes, they are extensively used for water storage. Thousands of vats are to be found in the large blocks of buildings in New York alone, many of them of enormous capacity and almost without exception made of wood. In Britain, during the expansion of the chemical trades, they have been adopted more generally, but there still appears to be room for their extension.

Wood vats to be successful must, however, be the best of their kind, made from suitable timber, in thoroughly seasoned condition, and the seasoning must be brought about by natural means, and not by desiccation or steaming. There is more in the art of vat making than may be supposed, and a firm exclusively engaged in this work, with large and varied stocks of timber, specially selected for that purpose, together with a staff of craftsmen who have served their time to and gained life-long experience in the trade is the best qualified to produce ideal work. Carpenters, cask-makers, and amateurs, on the other hand, have not the same chance of success.

The firm of Carty and Son, Ltd., London, has for the past 150 years been engaged exclusively in the production of wood vats and tanks, and all their experience and energies have been concentrated on that trade. Wooden vessels in pitch pine, Oregon pine, Russian fir, oak, Kauri pine, and red Louisiana cypress, are made to suit the particular purpose for which each may be required, and stocks of all these timbers may be seen in seasoned condition at their extensive premises. There are, of course, certain chemicals which are unsuitable for storage in wood by reason of their extra astringent or destructive nature, and in these cases linings of pure chemical lead, with joints properly burnt by experienced lead burners, are also supplied by the firm.

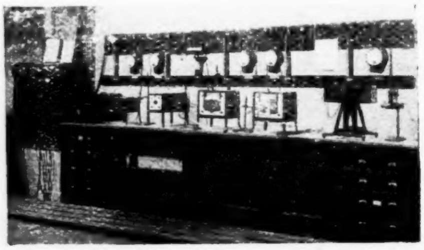
Graduated Laboratory Glassware

AFTER many years of experiments, A. Gallenkamp and Co., Ltd., 19-21, Sun Street, Finsbury Square, London, E.C.2, are now able to place on the market "Commercial Grade" Volumetric Glassware, designed to come within the limits of error allowed by the N.P.L. under Class B. Each instrument bears the trade mark "Technico" and is engraved with a serial number, Grade B. This glassware is graduated on their own premises by a skilled staff and with the latest approved method and machines. A section of the Graduating Department to which inspection is cordially invited is illustrated below.



The Glassblowing Department copes efficiently with repairs of any laboratory article—viz., new taps to broken burettes, grinding new keys, etc., and a speciality is the manufacture of new designs in glassware. Here emphasis may be placed on the fact that each man is highly qualified, having served a period of apprenticeship and being retained on expiration.

An illustration is given below of electric furnaces in the laboratory.



Considerable interest has been aroused during the last few years in the working of electric furnaces, especially the laboratory type, and after many and lengthy experiments Gallenkamp and Co. have been able to produce suitably designed furnaces for laboratory and small industrial heating. The object of effecting economy in working, compatible with highest efficiency and durability, is satisfactorily achieved.

The advantages of electric heating are obvious. It is clean, uniform temperature control can be maintained with ease and precision, and fumes are obviated, the furnace atmosphere being free from all products of combustion.

Standard types are vertical and horizontal tube furnaces, two and four tube furnaces, muffle, crucible and dental furnaces, etc. Their application to general research is varied —viz., determination of critical points in steel, assay of coal,

for carbonisation purposes, annealing high range thermometers, Muffle types can be used for ash determination of all materials, incinerations, research and heat treatment of all materials, enamelling, etc. These furnaces are in operation in all parts of the world and a list of users and testimonials will be willingly sent forward on application.

Gallenkamp and Co. will be pleased to post forward lists on request, and in particular draw attention to their circular 234B detailing prices of their standard unstamped " Technico " glassware.

" Arkon " Instruments

RECOGNISING that modern works processes must be scientifically controlled to yield the best results and that, on the other hand, the instruments must give a maximum of service for a minimum of attention, Walker, Crosweller and Co. have set out to produce a range of instruments which are really simple to install and as simple to keep in continuous operation. They claim that this has been done in the case of their " Arkon " instruments. Their trade mark " Arkon " is, we understand, taken from the Greek word " Archon " meaning " Leader."

These " Arkon " instruments comprise a wide range of gas analysis recorders for CO_2, O_2, SO_2 and Cl, gas volume indicators and recorders of the inferential type, draught and pressure recorders of many types, and an equally large number of thermometers and pyrometers. This striving after new and better types is continual, and the works manager, engineer, or chemist who thinks only of CO_2 recorders, for instance, as they appeared first about 25 years ago, would probably be surprised to see the great advance made by the latest types of such instruments.

This advance is general throughout the whole of the " Arkon " range of instruments. Thus, there are now included CO_2 recorders in multiple form up to sextuple sets, draught recorders which magnify readings accurately to ten times the normal and yet without any of the usual multiplying devices, gas volume recorders with charts no less than 2 ft. wide, and planimeters which will compute records on all such charts in one rapid sweep.

These are but a few of the " Arkon " instruments selected for menti on. It is a close race between the improvement of plant and process and the improvement of the recorder necessary to control it adequately, but readers may be advised to believe rather than to doubt that an instrument is always available to control their plants and processes and so help them to secure the best possible results therefrom. The diminishing band of people who refuse to consider instruments at all must drop farther and farther behind.

British Liquid Air Containers

THERE are a number of laboratory researchers who use double-walled vacuum flasks, generally known as " Dewar Flasks," and still hold the opinion that they are only obtainable from the Continent. This idea, however, is entirely erroneous, for, since the war, these flasks have been manufactured in this country. At first great difficulties were met with, and only the cylindrical pattern was manufactured, but since then great strides have been made. At present all types of vessels, such as globular, cups with and without feet, three-walled, etc., are obtainable at competitive prices from such producers as The National Glass Industry, 35, Lawrence Road, Tottenham, London. The smaller vessels are blown from good quality resistance tubing, while the larger are blown direct into special moulds, and all are doubly annealed, well silvered, and highly exhausted. These vessels can also be obtained with a vertical unsilvered window to permit inspection of contents during experiments.

It was found in the beginning of the manufacture of these flasks that a number of complaints were made that where the necks were fused a breakage occurred, but this difficulty was overcome in two ways. Firstly, a double annealing process was instituted into the works, and, secondly, flasks with a copper-coated mouth were introduced. The latter method has been found by the majority of users to be of great advantage in that it not only gives the flasks longer life but also saves loss of time and disappointing results. Who knows better than the scientist what it means to have an important calculation or test ruined at the last moment by the cracking or breaking of his apparatus ? Every genuine " Dewar Rex " flask is tested and guaranteed.

The Premier Laboratory Mill

PARTICULARS have been given from time to time in THE CHEMICAL AGE of the properties of the well-known Premier mill, the inventor of which, Mr. F. J. E. China, B.Sc., is chemist and plant manager for Burt Boulton and Haywood, Ltd., of London. This mill has long passed the experimental stage and is now one of the best known pieces of plant in connection with chemical and allied industries. Its industrial applications are almost without limit, but attention is particularly called to its usefulness in connection with creosoting of all kinds, dust laying and road binding emulsions, insecticides, disinfectants, etc., waterproofings, medicinal oil emulsions, pharmaceutical extracts, wax emulsions, intensive mixing of liquids and solids, tar oils, purification of organic chemicals, minute disintegration of solids and semi-solids in liquids, the treatment of clays in all branches, wet grinding of organic chemicals, homogenisation, ore separations, etc.

Although most widely known on account of its industrial applications it is of interest to point out that the mill is equally suitable for the finest uses of the laboratory and the exacting demands of advanced research work. The mill is furnished in five sizes. Large mills will be specially designed for quantity production. The Standard No. 15 will produce up to 1,500 gallons per hour according to the nature of the materials, viscosity, and degree of dispersion required. The " Midget " with 1-inch rotor is designed for drug stores, soda fountains and domestic use. Standard No. 5 size is the laboratory mill to which in an issue dealing with scientific instruments particular attention may now be directed.

A Recording Water Tester

IT has been realised frequently in the past that the utility of water testers would be greatly increased if they could be made to give a continuous record on a chart, but the changes in the solution under test caused by electrolysis, and the difficulty of continuously compensating the apparatus for changes of temperature, have presented great obstacles in the development of a recorder of this kind.

Now, however, Evershed and Vignoles, Ltd., electrical engineers, of Acton Lane Works, Chiswick, London, have produced the Recording " Dionic " Water Tester which overcomes these difficulties. The liquid to be tested is caused to flow continuously through a tube containing electrodes fixed at a suitable distance apart, between which current is passed. A recording instrument records electrically on a chart the conductivity of the liquid, and thus provides a continuous graphic record of the degree of purity of the water or the strength of the solution passing through the tube. The current for the measurement is provided by a small direct current generator, which forms part of the equipment, and which is driven by a motor connected to any convenient source of electrical supply.

The recording instrument, as in the original " Dionic " Water Tester, is, in effect, an ohmmeter, and it may be equipped with an automatic alarm for the purpose of giving audible or visible warning of any change, beyond certain limits, in the condition of the liquid.

The new apparatus will be of added value in the many industries in which the original " Dionic " Water Tester was of proved utility.

A Centenary of Laboratory Apparatus Production

JOHN J. GRIFFIN AND SONS, LTD., of Kemble Street, Kingsway, have for many years devoted their attention to the manufacture of special apparatus required for research and industrial laboratory work. It is now 100 years since the foundation of this firm—this year being the centenary year. The founder, John Joseph Griffin, was the designer of the squat form spouted beaker, which is now known throughout the world as the " Griffin " pattern. In addition to this he was a prolific writer on scientific and industrial subjects. Some of his works, which were published many years ago, are still used as the

basis for some of the modern methods of industrial testing. The firm has always kept pace with the modern methods of its time. At the present day they are manufacturing a special form of hydrogen ion apparatus, bomb calorimeters, and all the various equipment required for the testing of oils, cement, petroleum, etc., modelling their apparatus, as far as possible, upon the designs suggested by the standardising committees. They hold an enormous stock of chemical, physical, and industrial apparatus. They employ an expert staff whose services are always at the disposal of those who require advice upon the products which they manufacture, and the carrying out of designs suggested by their clients. The firm, in addition to their home business, have a very large export business in all parts of the world.

A Steam Driven Gas Compressor

In their endeavours to produce the most efficient chemical plant, Joseph Foster and Sons, Soho Foundry, Preston, have evolved a gas compressor which they claim to be one of the most efficient in the country. The compressor is of the horizontal tandem pattern operated by means of a steam cylinder working non-condensing, the compressor cylinder being arranged behind the steam cylinder and driven direct by means of a tail rod supported by an intermediate slipper and slide.

In addition to the usual features in engines of this type, such as massive bedplate, cast steel crosshead, a fly wheel weighing 20 tons, it also embraces many which cause the compressor to rank highly in the estimation of chemical engineers. The valve gear of the steam cylinder is of the slide valve type supplied with "Meyer" variable expansion cut-off plates. The operation of this valve is by means of the usual eccentrics from the crankshaft, and the variation in cut-off is actuated by means of a handwheel on the cut-off valve spindle, so arranged as to make the cut-off adjustable while the engine is running. The compressor cylinder is water-cooled, the jacket being cast around the cylinder barrel and having an open top. The delivery ports are brought to the top of the cylinder and the inlet and outlet mechanically operated by means of a multi-ported, slide valve, having a trick port therein. Apart from the barrel, the delivery port and suction inlet are both water-cooled, the water being admitted at the bottom of the barrel casting, overflowing at the top, the casting being left open in the water chamber for cleaning-out purposes. Other valves of special design are fitted to the top of the multi-ported slide valve for the delivery of the gas.

A special feature of this design is the relief of compression at each end of the stroke by means of the above-described trick port in the valve, and also the precautions taken for the delivery of the gas through the specially designed valves. A further feature is an arrangement by means of which the compressor can deliver its contents at different pressures at each end of the stroke. The speed is controlled by means of a specially designed governor which can vary the speed of the engine from full load to 60 per cent. of the full load whilst running to accommodate the demand.

Three engines are now being completed for a large chemical works in this country for whom the company have constructed many similar new engines in the past, apart from replacing those of other well-known makes.

No More "Made in Germany"

Before the war it was the usual thing to find a large percentage of the apparatus of a laboratory bearing the words "Made in Germany" or "Made in Austria." It is now no longer necessary further to continue, as the entire requirements for either physical or chemical laboratories can be obtained from British sources. For example, W. and J. George, Ltd. (proprietors of F. E. Becker and Co.), of Great Charles Street, Birmingham, take a natural pride in the fact that their works are completely self-contained for the purposes of laboratory apparatus manufacture, and do not require outside help in any form for producing any type of chemical or physical apparatus. One advantage of dealing with actual makers, apart from the saving in cost, is the ability to secure, without any doubt or inconvenience, spare parts and replacements from stock. The firm issue two profusely illustrated and descriptive catalogues of chemical and physical apparatus, which include practically every form of scientific apparatus, and show a particularly wide range of balances and weights made in their own workshops. The micro-chemical analytical model is an improved model, sensitive to 1/100th mgrm. In addition to apparatus, the firm, of course, supply all the usual chemicals and reagents.

Tube Bending Machines

C. A. Hunton and Sons, 71, Southwark Street, London, S.E.1, issue an interesting pamphlet relating to the "Hilmor" tube bending machine for producing any desired bends on tubes in brass, copper, aluminium, steel, electric conduit, split or butt joint. This machine is specially designed for bending light-gauge metal tubes and the company's patents cover advantages not usually obtained in other machines. As tubes are, of course, largely used in chemical works, this machine should be of particular interest in the chemical industry. We note that the "Hilmor" machine is now made suitable for universal as well as standard bending, and attention is also directed to machines fitted with the "Hilmor" patent pointer lever. This lever, by adjustment, automatically finds the correct bending position relative to the size tube on any size radius, and enables the operator to make his own additional formers. These formers can easily be turned up in hard wood for general copper or brass tube bending, or can be supplied in cast iron on request. This gives the benders similar advantages to a drilling or milling machine, whereby the operator is able to fit the desired drill or cutter he requires.

Balances and Weighing Instruments

The work of the chemist, whether engaged on matters of a purely scientific nature, or endeavouring in the works laboratory to find the most satisfactory and economical method of producing an article, demands accuracy and speed. In the past he has been content to purchase an instrument of a foreign make, believing it to be superior to British products. The chemist of to-day fully realises that the articles produced in this country compare favourably with German or other makes, at the same time maintaining the prestige of his own country.

W. A. Webb, Ltd., London, are still manufacturing the balances that were in such a great demand during the late war. They also supply any type of weighing instrument, whether for ordinary purposes or for some special purpose, for weighing, for estimating or counting, for weighing small quantities or in bulk, for fine drugs and precious metals, and are always prepared to depart from standard lines for special purposes.

James Woolley's Lists

The price lists of chemical and scientific apparatus issued by the well-known firm of James Woolley, Sons and Co., Ltd., of Manchester, cover practically the whole range of laboratory requirements and indicate the very large proportion of products now available of British manufacture. The articles are priced and those illustrated numbered for convenience in ordering. The large scale on which the business is conducted ensures a prompt supply, and the firm's intimate knowledge and long association with the business guarantees intelligent handling of all inquiries.

Neocellon Flameproofing Solution

Neocellon, Ltd., manufacturers of industrial lacquers, varnishes, and dopes, of Garratt Lane, Wandsworth, London, announce the production of a new flameproofing solution for impregnating electric wires and cables, wood, fabrics, etc. The preparation is described as a non-inflammable, watery, colourless solution with which any porous materials may be impregnated and rendered flameproof. It is understood to be especially applicable in the paper, textile and wood industries. The solution does not affect the colour or strength of any material to which it is applied, since it is odourless, transparent, non-poisonous and non-hygroscopic. Various tests have been carried out on material treated with Neocellon, and it has been found that even when petrol was poured over the material and

set alight only the spirit caught fire, whereas the fabric remained intact with only a slight charring effect. The company offer to supply free samples on application.

A description of the properties of the solution is printed on paper treated with the Neocellon solution, and even when inserted into a gas jet the paper refuses to ignite.

Boric Oxide as a Constituent of Laboratory Glass

(From a Correspondent)

Durable laboratory glassware is essential to the progress of industrial chemistry and medical science, and it will not be questioned that the use of boric oxide (introduced into glass by including borax or boric acid in the " batch ") in the development of glasses of low thermal expansion and maximum durability has been one of the most notable features of glass technology during the last half century.

Prior to the investigations of Abbe and Shott there were but two types of glass—the lime-alkali-silicate and the potash-lead-silicate. The Jena borosilicates evolved by the chemists mentioned above represent the earliest practical application of boric oxide as an ingredient of glass. The superiority of these glasses was quickly appreciated, and they monopolised the chemical glassware markets until 1914. With the outbreak of war came the vital necessity of establishing the industry in this country, and the rapidity and success with which British glassmakers developed and supplied the requisite varieties were notable achievements.

The research work carried out by the Department of Glass Technology of Sheffield University has been of inestimable service to the glass industry, and has included a thorough investigation of the influence of boric oxide as a constituent of resistance glass.

It is not feasible to deal adequately with this subject in the space of a brief article, but the following paragraphs describe some of the properties of glasses containing boric oxide and indicate their suitability for laboratory vessels and apparatus.

Among the several factors controlling the degree of thermal endurance and tensile strength of glass a low co-efficient of expansion is of vital importance. Professor Turner and Mr. S. English recently studied the influence of boric oxide upon the thermal expansion of simple glasses containing only silica, soda and boric oxide. It was found that by increasing the proportion of boric oxide the co-efficient of expansion diminishes to a certain point and then increases. The glasses examined were divided into two series, viz. :—

" A " (containing 20 per cent. Na_2O).—The minimum thermal expansion occurred with approximately 17 per cent. B_2O_3.

" B " (containing 10 per cent. Na_2O).—The thermal expansions were lower than in previous series, and the turning point was definitely marked at 20 per cent. B_2O_3.

The following table gives the absolute co-efficient of linear expansion of several well-known glasses ; the measurements were taken by the U.S.A. Bureau of Standards, and the Fizeau-Pulfrich interference method was employed. The second column shows the percentage of boric oxide in the glasses.

Linear Expansion.

(Determined by the U.S.A. Bureau of Standards.)

Glass.	Per cent. B_2O_3.	Co-efficient of linear expansion per degree centigrade from 10 to 55.
Kavalier	—	0·00000759
M.E.G.	3·6	0·00000600
Pyrex	11·8	0·00000334
Jena	10·9	0·00000479
Nonsol	6·2	0·00000640
Fry	8·1	0·00000596
Libbey	10·8	0·00000506

Pyrex glass (with 11·8 per cent. B_2O_3) has the very low thermal expansion represented by 0·00000334, whilst Kavalier (free from B_2O_3) has the highest figure in the table.

These glasses were also tested to ascertain their resistance to mechanical shock : beakers were dropped, bottom down, on a board 1½ in. thick, resting on a table with a wooden top an inch thick, from heights increasing by 5 in. until the beaker broke or stood a fall of 45 in. The drop tolerated by the Pyrex beakers averaged 31 in., whilst with Kavalier beakers the figure was 6·6 in.

Thermal endurance was determined by several tests, the most severe being described as follows :—Vessels containing 200 cc. of melted paraffin were heated to about 215° C., removed from the hot plate, the paraffin stirred with the thermometer until the temperature fell to 200° C., and the vessels plunged into ice water. It was conclusively proved that the degree of durability increased with the proportion of boric oxide.

In a series of glasses in which silica was replaced continuously by boric oxide, whilst the sodium oxide content remained constant, it was found that the durability to water, measured by the amount of alkali extracted by boiling water, increased with the proportion of boric oxide in the glass until a maximum durability was attained with about 12 per cent. of the oxide, after which the glass was more readily corroded : glasses of which boric oxide is a constituent are also more resistant to the action of steam under pressure.

Glasses rich in B_2O_3 are not the most resistant to either strong or dilute caustic soda solutions. The U.S.A. Bureau of Standards report asserts that " alkalis cannot safely be evaporated in any glass of which we have knowledge." The best glasses for this purpose are those containing approximately 5 per cent. B_2O_3. Glasses with generous boric oxide content are least affected by the action of ammonium sulphide, ammonium chloride, ammonia, potassium carbonate, sodium carbonate, and sodium phosphate.

The influence of boric oxide upon the acid-resisting properties of glass depends upon the relationship of the amount of this to other oxides present, especially silica. Among glasses tested with hydrochloric acid, some rich in B_2O_3 showed appreciable loss, whilst for others (with high B_2O_3 content) the loss was small. It is noteworthy that Pyrex glass (11·8 per cent. B_2O_3 and 80 per cent. SiO_2) is but slightly attacked by hydrochloric acid. Sulphuric and nitric acids have no corrosive action on borosilicate glasses.

The following excerpt from a paper published in *The Transactions of the Society of Glass Technology*, 1923, describes the effect of boric oxide upon the rate of melting and refining of glass : " The replacement of silica by boric oxide (the amount of sodium oxide remaining approximately constant) was accompanied by a very distinct reduction in the time needed to obtain the glass batch-free. A marked improvement also was found in the rate of elimination of the seed or bubbles from the glass."

It will be recognised that the utility of durable glass is not confined to laboratory ware, and boric oxide is an essential constituent of glass for miners' lamps, illuminating ware, water-gauge tubes, thermometers, battery jars : quite small quantities increase the durability of lead oxide glasses (English " crystal glasses "). Added to the " batch " for the higher grades of container glass boric oxide gives resistance to the corrosive action of acid juices and also reduces breakages when the charged vessel is heated (as in the instance of preserved meat).

Industrial Crawling Tractor Crane

A Recent American Production

A locomotive crane is not a tool adapted for use in a few industries. It is a labour-saving device which is far more versatile and has a much greater field of usefulness than any other machine whose function is handling material. It is not only useful, but it has become practically a necessity on railroads, in shipbuilding plants, in the iron and steel industries, in lumbering operations, in coal yards, on contracting work, in sugar manufacturing, in foundries, on docks and in practically all manufacturing plants.

Crawling tractor cranes have been developed to extend the usefulness of the locomotive crane beyond the limitation of rails, and now several manufacturers of material-handling equipment have already entered this field, among them the Industrial Works, Bay City, Michigan, who for the past 52 years have been building locomotive cranes and crane equipment.

They have just announced a new and greatly improved 10-ton crawling tractor crane. This crawler crane, known as their type DC, is very similar in outward appearance to

the former types of tractor cranes built by that company, but its design embodies a host of new engineering features such as split gears for propelli g, increasing speeds, double clutch mechanism, unusually long tractor belts, independent functions, etc., which, it is claimed, make that machine the fastest, simplest, sturdiest and most rugged type yet produced, and the most economical to operate.

The most important of all the new features is the system of split gears by which each tractor belt is separately controlled. Two concentric vertical propelling shafts at the axis of revolution lead two independent but concentric trains of spur and bevel gears, each operating one tractor belt. Each belt is directly controlled by two powerful friction clutches and brakes in the revolving upperworks, which gives absolutely independent, definite and easy control over each belt while propelling. This is an all-gear drive from engine to sprockets with no chains in the mechanism at all. The Industrial type DC is said to be the only crawler crane which steers and propels by friction clutches. It is also said to be the only crane which has a friction clutch and band brake for each tractor belt. These features make manœuvring in close quarters comparatively simple.

All speeds of the motor-operated crane have been increased 25 per cent., which provides ample speed for the fastest

possible handling of all materials. This new feature should make for great savings in time and corresponding economies in money.

The double clutch mechanism by which the two slewing band clutches are operated by one lever makes for very simple slewing. The direction of slewing is changed at will by the movement of the slewing double clutch lever. No reversal of the engine is necessary.

The crawling tractor belts are of ample length to give plenty of stability when lifting over either end, on any kind of ground.

The centre distance between the two end sprockets on the DC is 10 ft., one of the longest on the market to-day, giving ample stability and support for a large range of operation.

All functions of this crane are absolutely independent of each other, which means greater certainty of operation. Separate levers actuating each function are conveniently placed on the operator's platform in the revolving upperworks. Different combinations of these independent functions may be utilised at one time to great advantage.

This crane can be equipped to operate with a steam engine, electric motor, gasoline motor or fuel oil engine of the Diesel type to suit any operating conditions known to-day. It is extremely versatile, operating with clamshell or dragline bucket, electro-magnet, hook and block or grapple. It is readily convertible into a shovel or a pile driver. Any equipment that operates on a boom can be applied.

The utmost care has been used to combine the necessary strength with the light weight essential to a tractor crane, and convenience in operation and maintenance has been provided to the highest possible degree. The makers are confident that this new improved crane will continue to supply a demand for a general utility crane of small capacity sturdily built. It has already found a ready market in practically all fields of industry.

Oil and Petrol Handling

We have received from the Dowson and Mason Gas Plant Co., Ltd., Levenshulme, Manchester, their latest pamphlet on oil and petrol storage handling equipments, with particulars of the 50-gallon portable oil tank complete with self-measuring pump and meter of their storage cabinet, and of the "Beardmore" barrel emptying and can filling pumping set. These pumps, it may be mentioned, have been submitted to and approved by the Standards Department of the Board of Trade.

It is pointed out by the company that to-day more than ever it is essential for firms to look into their costs of production and it is increasingly recognised that great savings can be effected in the simple and efficient handling of petrol, oil, paint, turpentine, paraffin and similar liquids by the Beardmore bulk storage system. The number of testimonials and repeat orders received are perhaps the best evidence of the extent to which the firm's equipments satisfy industrial requirements, and also that British products can still hold their own for efficiency and quality in the face of the severest foreign competition. The pamphlet gives full illustrated details of the company's productions.

Italy's Chemical Progress

Dr. G. Poggi, secretary of the Italian Chamber of Commerce in London, surveyed Italy's chemical industry in a recent lecture at the City of London College.

The chemical industry, he said, developed greatly during the war, prior to which Italy depended principally upon Germany for many chemicals. The principal branches of this industry in Italy were those engaged in the production of chemical fertilisers and sulphuric acid. The output of sulphuric acid increased between 1893 and 1913 from 60,000 to 630,000 tons, and that of superphosphates and other chemical fertilisers from 72,000 tons in 1893 to 947,000 in 1922. The application of electric power in the chemical industry had been responsible not only for the manufacture of calcium carbide but also for the manufacture of calcium cyanamide, the production of which rose from 4,470 tons in 1911 to 30,840 in 1922. Rapid progress was being made in the production of synthetic ammonia, several new installations having been erected recently in various parts of Italy where there were ample resources of hydro-electric power. The alkali branch had not attained great importance owing to lack of raw materials, but even there progress had been made, the caustic soda production having risen from 2,500 tons in 1903 to 37,200 in 1922. The manufacture of sulphate of copper more than trebled in the last twenty years. Progress was also recorded in the production of soap, fine chemicals and drugs, and in colouring matters and dyes.

British Aluminous Cements

For the re-laying of Westminster Bridge and Gresham Street, tasks which have just been completed, a British rapid-hardening cement was used in both cases. Since the trial was made in December last of re-laying a section of Piccadilly with a British rapid-hardening aluminous cement side by side with a similar type of French cement, a new era has set in for the British industry. In the recent re-laying of Sloane Street, the same British cement, viz., "Ferrocrete," was employed, and for the reconstruction of Westminster Bridge the London County Council Engineer also specified the use of "Ferrocrete." The brand known as "Lightning" was specified by the City Council Engineer for the re-laying of Gresham Street, and the same brand was used for Victoria Street, Belfast, where the whole work of reconstructing the tramway track was carried through within a week, the time saved being estimated as three weeks.

Aluminous cement was discovered in 1908, but was not converted into a commercial proposition until four or five years ago. Until quite recently it was manufactured only in France, but it is now being successfully made in this country. Its chief characteristic is its rapid-hardening property, and while its use for road construction is likely to lighten the transport problem in great cities, it is probable that its adaptation to building construction will also considerably facilitate the problem of "shuttering," which was regarded by the Moir Committee as one of the principal obstacles to the rapid and economical construction of concrete houses.

The Development of the Hardinge Mill

By J. C. Farrant, M.A.I.M.E.

Further notes are published below of developments and improvements in design of the Hardinge Mill, with particulars of operating data.

Two-Stage Grinding

THIS refers to ore reduction in two stages by the same type of mill, or by using primary and secondary grinders. With the displacement of the stamp, particularly in large mills, it is common practice to crush finer than 1½ in. or 1 in. for ball milling in contradistinction to the 2½ in. and 3 in. feed commonly sent to the stamps, for it has been found that bringing ore down from, say, 3 in. to below 1½ in. is performed more efficiently in the crushing department than by attempting to make the ball mill bite off more than it can chew.

The first two-stage Hardinge mill gold milling plant was erected in 1911 at the Vipond Gold Mines in Porcupine. C. H. Poirier was consulting engineer. The writer went up to that district to start up the plant in the same year. This small mill of 100 tons per day capacity was divided into two 50-ton sections, each section having a 4 ft. 6 in. dia. Hardinge ball mill followed by a 6 ft. Hardinge pebble mill, working in closed circuit with Colbath classifiers. The flow sheet was simple, consisting of a Blake type crusher, Buchanan rolls and elevator to the ore bin. The ore was delivered by means of two James feeders to each 4½ ft. dia. ball mill. The product from the ball mills went direct to the classifiers, which were set to deliver 100 mesh overflow. The 100 mesh passed direct to amalgamating tables, and the oversize from the classifiers was delivered to the 6 ft. Hardinge pebble mills. The product from the pebble mills was delivered again to the classifiers, so that nothing passed to the amalgamating plates except through the classifiers. A screen analysis of this plant is given below :—

Plant	Vipond Gold Mining Co., Porcupine (June 28, 1912).
Mills used	Two 4½ ft. dia. by 13 in. ball mills. Two 6 ft. dia. by 72 in. pebble mills.
Gangue	Basalt and quartz.

	Feed.	Product.
1 in.	4·50 per cent.	
¾ in.	17·0	
½ in.	31·0	
¼ in.	24·70	
10 mesh	11·86	
20 ,,	4·17	
– 20 ,,	7·0	
30 ,,		
40 ,,		
60 ,,		
80 ,,		
100 ,,	—	2·56 per cent.
200 ,,	—	29·10
– 200 ,,	—	68·44
Capacity	100 tons a day, both units.	
H.P.	30 for both ball mills. 70 for both pebble mills. Total 100 H.P.	

The work of one 4½ ft. ball mill at this plant is given as typical of this size of mill :—

Feed		Product (from ball mill).
As shown above :	10 mesh	8·50 per cent.
	20 ,,	18·40
	40 ,,	20·78
	60 ,,	8·30
	80 ,,	6·70
	100 ,,	3·30
	– 100 ,,	34·02

DATA FOR ONE MILL.

Capacity	50 tons per day of 24 hours.
Ball charge	4,000 lb. 5 in., 4 in., and 3 in. forged steel balls.
R.P.M.	32
H.P.	15
Water	66 per cent. by weight.
Ball consumption	·6 lb. per ton.

The plant ran for some time with amalgamation only, but later it was changed to cyanidation, and one of the 4½ ft. mills was replaced by a 6 ft. Hardinge ball mill. The plant started up and operated very well without a hitch of any consequence, and Poirier, who had been used to stamps, made the humorous observation that "the plant always had him fussed," as he never knew whether it was running or not until he had opened the mill door, in contradistinction to stamp mills which made their presence heard for a considerable radius. This is a point which is not often mentioned, but still is important. It is much easier for men to run ball mills than stamps, as the noise is very much less, and, further, noise is power gone to waste.

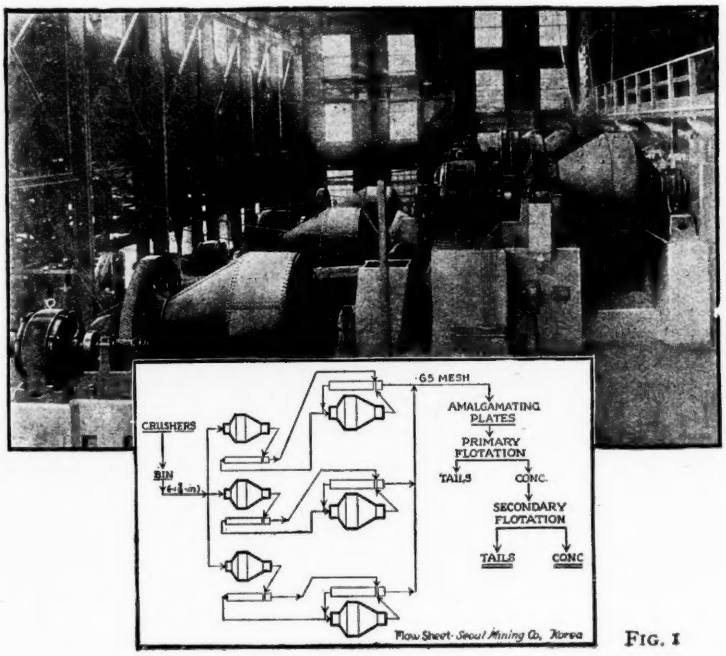


FIG. 1

Naturally this mill created considerable interest in a stamp mill country, and other installations followed at plants mentioned before, such as the Dome and the McIntyre.

An excellent example of two-stage grinding by Hardinge ball mills and pebble mills is of British-made mills installed at the Tul-Mi Chung plant, Korea. These mills were despatched in 1914 after the outbreak of war and have been running continuously until the mine was closed this year.

The ore consists of silicious limestone and a considerable amount of lime garnet, which is exceedingly hard. The plant has maintained

an average of about 450 tons per day. Screen analysis given below. A view of the plant is shown (Fig. 1).

Plant	Tul-Mi-Chung, Korea.
Mills used	Three 6 ft. by 16 in. ball mills. Three 8 ft. by 36 in. pebble mills.

DATA ON 6 FT. BALL MILL.

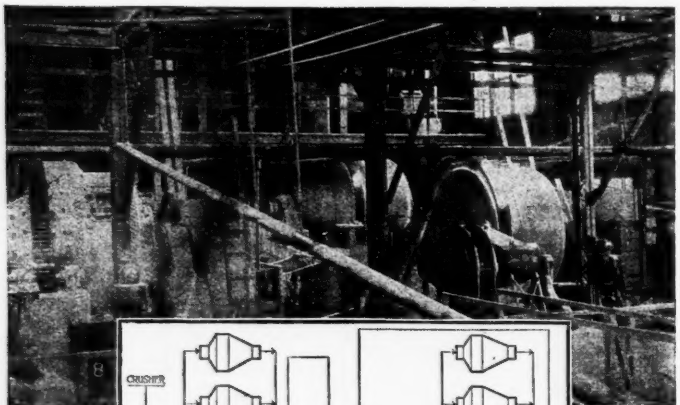
Mesh.	Feed.	Product.
On 1	18·2 per cent.	—
4	45·6	—
6	4·2	—
8	3·2	—
10	2·6	0·7 per cent.
14	2·0	1·7
20	1·0	3·1
28	1·7	4·8
35	1·1	8·6
48	1·4	8·6
65	0·7	9·7
100	1·6	12·0
150	1·4	10·2
200	0·9	7·6
Through 200	3·5	33·0

Capacity	155 tons (average) each mill per 24 hours.
Charge steel balls	10,000 lb.
R.P.M.	27½
Power input	39 H.P.
Moisture	33 per cent. water by weight.
Consumption of balls	0·47 lb. per ton.
Lining	0·2 lb. per ton.

DATA ON 8 FT. PEBBLE MILL (IN CLOSED CIRCUIT WITH DORR CLASSIFIER).

Mesh.	Feed	Product. Classifier overflow.
On 4	0·1 per cent.	—
6	0·3	—
8	0·7	—
10	0·9	—
14	2·7	—
20	4·7	—
28	9·5	—
35	13·5	—
48	11·5	—
65	13·5	0·6 per cent.
100	14·8	8·8
150	10·8	16·6
200	6·8	18·00
Through 200	10·2	56·00

Capacity	(120 tons approx.) each Mill per 24 hours
Charge Pebbles	14,000 lbs.
R.P.M.	26
Power input	55 h.p.
Moisture	33 per cent. water by weight.
Consumption of Pebbles	2·3 lbs. per ton.



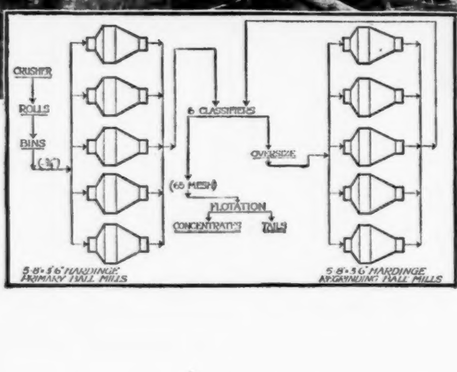


FIG. 2

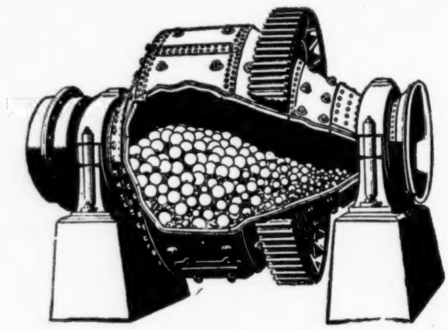


FIG. 3

COST PER TON MILLED—1918.

154,300 TONS MILLED.

Department.	Supplies. $	Power. $	Labour. $	Total. $
Crushing	0·0643	0·0322	0·0177	0·1142
Sorting	—	—	0·0033	0·0033
Grinding	0·1784	0·2541	0·0153	0·4478
Flotation	0·2588	0·0474	0·0074	0·3137
Tables	0·0074	0·0039	0·0016	0·0129
Regrinding	0·0247	0·0390	0·0016	0·0654
Tailing-Elevating	0·0011	0·0137	—	0·0148
Slime-Plant	0·0046	0·0050	0·0064	0·0160
Tailing-dam	0·0019	—	0·0188	0·0390
Water-supply	0·0034	0·0354	0·0002	0·0390
Mill-heating and Lighting	0·0316	—	0·0007	0·0323
Building Repairs	0·0009	—	—	0·0009
Fire-protection	—	—	—	0·0004
Supervision	0·0188	—	0·0580	0·0768
Assaying	0·0226	—	—	0·0226
Total	$0·6185	$0·4307	$0·1310	$1·1991
Each at 4·80	·3d.	·21d.	·65	4s. 11½d. per ton.

NOTE.—Electricians' labour included with power.

NOTE.—These costs have since been materially reduced as the company obtained their power at a lower figure after 1918.

REGRINDING BALL MILLS.—The above two cases are the first types of two-stage grinding in which pebbles were used in the regrinding machines, but the war played its part of effecting milling practice.

The majority of fine grinding in ore reduction plants was carried out by means of Danish and Flint pebbles; they were even imported into Korea as well as the United States and Canada. During the war, however, these shipments ceased. Local pebbles—I speak generally, not universally—were tried with indifferent results, and experiments were then made with small cast iron balls. It took some time before the correct mixture was found and the method of casting. In the earlier stages consumption was high. At the present time regrinding, say, from below ¼ in., is carried out by metal grinding media, local conditions, of course, often dictating which media is preferable, but the advantage to the consumer of employing balls in the regrinding mills is that roughly twice the tonnage can be put through for twice the horsepower in the same floor space as could be ground by pebble mills. In other words, one regrinding ball mill can do as much work as two pebble mills of the same size. Under these conditions the mill building can be made smaller, with a consequent reduction in capital outlay for both mills and building.

An excellent example of two-stage grinding with Ball Mills is the Miami Concentrator, capacity 7,500 tons per day, and a screen analysis of which is shown.

Screen Analysis

Plant	Miami Copper Co.		
Mills used	8 ft. by 36 in. Hardinge Ball Mill.		
Mesh.		Feed per cent.	Product.
On	3/4 in.	1·1	—
,,	1/2 ,,	13·8	—
,,	3/8 ,,	13·7	—
,,	1/4 ,,	12·2	—
,,	3/16 ,,	7·4	—
,,	1/8 ,,	9·3	—
,,	10 Mesh	8·3	—
,,	14 ,,	4·4	—
,,	20 ,,	3·3	—
,,	28 ,,	4·0	·0%
,,	35 ,,	2·4	·1%
,,	48 ,,	2·7	·4%
,,	65 ,,	2·0	3·8%
,,	100 ,,	1·5	14·2%
,,	150 ,,	1·0	14·8%
,,	200 ,,	1·3	6·3%
	200 ,,	10·7	60·4%

The capacity per section averaged 1,200 tons per day. It should be noted that the practice here is to feed the 1,200 tons direct into the first mill (Primary). The product from this is classified and the oversize reground in two secondary regrinding mills. Each 8 ft. dia. by 36 in. cyl. Hardinge Mill is driven by 150 h.p. motor. There are six sections of three Mills in each section, making a total of 18 mills with a total tonnage of 7,500 tons per day to 65 mesh. Six more Hardinge Mills have now been added.

The flexibility of this method is apparent, as assuming the feed to be a little coarser, due to wear of the crushing department ahead, a part of the product from the primary mill can be diverted back again to the feed end, thus putting the primary mills in closed circuit as well as the secondary mills, thus effecting a balance. With a finer feed with new screens in the crushing department, the capacities per section have frequently run up to 1,400 tons per day, at which tonnage the Primary Mills are handling nearly 1 ton a minute.

One of the latest large Plants built is the 3000-ton Sullivan Concentrator of the Consolidated M. & S. Co., of Canada.

This is a Silver Lead Ore of high specific gravity, but not particularly hard. The Flow Sheet consists of Primary and Secondary breaking, two sets of Rolls in series to minus 1 in. This is delivered to the Mill Bins. The rest of the Mill is in two sections consisting of one 8 ft. dia. by 48 in. cyl. latest type Primary Hardinge Ball Mill followed by two 8 ft. dia. by 48 in. cyl. Regrinding Mills, making a total of six for the 3,000 tons. A seventh Hardinge Mill has been added in order to ensure that the pulp leaving the Mill shall not exceed a 5 per cent. residue on 200 mesh. Differential Flotation is successfully employed at this Mill on Lead Zinc Values.

This Plant probably represents the finest grinding that is carried out at least on a large scale in present day ore reduction. Data is given herewith, which was taken shortly after the plant was started up :—

Feed	3/4 in.
Product	95 per cent. minus 200 mesh.
Ball and Lining Consumption	1·26 lbs. per ton.
Power consumption	16 h.p. hours per ton.
Capacity	2,400 tons per day.

These results have been improved upon, but further details are not to hand at the time of writing, but as much as one ton a minute has been ground in the 8 ft. by 48 in. Primary Mills.

A photo is shown on the previous page (Fig. 2) of the Ohio Copper Co.'s plant, showing another arrangement of two stage grinding. Data is also given :—

Mills used	8 ft. by 36 in. Hardinge Mill.
Gangue	Quartzite.
Feed	3/4 in.
Product	90 per cent. — 65 mesh approx.
Capacity, per section	533 tons per day 2 Mills.
,, Total	2,665 ,, ,, ,, 10 ,,
H.P. per section	268—2 Mills.
H.P. Total 1,340—10 Mills.	

The data submitted in this and previous articles in the CHEMICAL AGE covers ore reduction by Hardinge Mills from 1908 up to the present time.

Fig. 3 serves to indicate the peculiar segregation which takes place in the conical mill.

The peripheral speed is greatest at the cylindrical portion of the mill and it is here that the largest grinding media are found and where they act upon the incoming coarse feed; as the material being ground passes to the discharge end in ever decreasing sizes it is subjected to the action of the smaller grinding media. By this means a maximum amount of energy is transformed into useful work. The discharge cone assists in the rapid discharge of the fines, thus lessening the cushioning effect within the mill, which retards grinding.

Yorkshire Chemist's New Detergent

FOR a new detergent discovered by Mr. R. R. Etches, Leeds, it is claimed that its active properties and economic use make destruction of the fibre mass in the scouring of wool impossible and lead to an unusual cleanliness in the scoured wool with the wool-fat unimpaired.

In dealing with "slipe," where the wool is removed from the skin by lime, rendering it difficult to bring the wool into a workable condition, so little do the calcium salts affect the new composition, whose chief merits are physical not chemical, that its advantage over the ordinary forms of detergents is plain. Again, anything that expedites the removal of 20 per cent. grease at a low cost and with a high degree of safety and efficiency from the points of view of a clean and undamaged fabric, is certainly desirable. Mr. Etches claims that his detergent has these qualities, and, further, there is no "bleeding," which frequently occurs where soda ash or soap is used, according to a writer in the *Manchester Guardian Commercial*. Coming to the scouring of cloth, in one test of the new dertergent it is claimed that the scouring occupied 30 minutes and the washing off from 30 to 70 minutes, compared with the two to three hours usually occupied in the mill where the demonstration took place. The scouring was done with 4 Tw., against the usual 10 Tw. alkali, and as 5 Tw. of Mr. Etches' cleaner is said to be equal in cost to 10 Tw. alkali liquor, it followed that there was a saving on one-fifth of the cost of the alkali.

An important claim made for the cleanser is that even where it is necessary to use it at a high Tw., as in the case of stripping, it does not adversely affect the fabric.

Gas Exhibit at Wembley

THE large and popular Pavilion of the British Empire Gas Exhibit in the centre of the Palace of Industry at Wembley last year will again be occupied by the gas industry at Wembley this summer. An entirely new show has been devised, and it is significant of the enterprise and progress of the industry that additional adjoining space has also been taken.

A special feature of the exhibit will be a display, with an Imperial keynote, showing that gas is already freely used and is fast making headway, for industrial no less than for domestic purposes, not only in Great Britain but throughout the Dominions and Colonies. Important industrial uses of gas and of gas coke will be demonstrated on a comprehensive scale, while in the large and artistic rest lounge, which visitors to the Exhibition have made a habit of using as a convenient and comfortable rendezvous, the solution of the housewife's troubles by the use of gas on modern labour-saving lines will be the main attraction. In addition, part of the new space taken will be turned into a hall where demonstrations on the cookery of Empire foods, preceded by short lectures, will be given several times a day.

Discovery of Graphite Deposits

WHAT are described in a Scandinavian report to the American Chemical Society as the world's richest deposits of graphite have been discovered in Greenland. "An American engineer, Mr. J. R. Sweet," says the report, "sent from Horten, Norway, has been in Greenland for a whole year on work for a graphite company. Arriving at home, he reports having found the biggest graphite deposits in the world, sufficient for large-scale mining for at least 100 years. By using appropriate methods of refining, the working can be made very profitable, notwithstanding the rather peculiar working conditions. Sweet is of the opinion that Greenland is enormously rich in minerals, and ought to be opened to foreign capital and initiative."

The Future of Motor Fuels

Professor Brame Outlines Possibilities

PROFESSOR JOHN S. S. BRAME (Past President of the Institution of Petroleum Technologists) is delivering the Howard Cantor Lectures before the Royal Society of Arts, in London, and the first of three lectures was delivered on Monday, April 20, on " Motor Fuels." The lecturer reviewed the whole subject, considering, in the first place, the ways in which the greatly increased demands for motor spirit had been met hitherto, the prospect of meeting the undoubtedly still greater demands of the near future.

Increased Demand from Motoring

Discussing the increasing demands for fuel from the rapid development of motoring and aviation, Professor Brame said that last month the approximate figure of 500,000,000 gallons was given in the House of Commons as the English consumption for 1924. It was almost beyond speculation what the world's demands might be ten years hence. Whilst the motors in 1924 were 15 times the number in 1912, the crude oil output was approximately only three times as great in 1923 as compared with 1912. In 1912 the crude oil production was 47,655,900 metric tons, whilst the estimated figure for 1923 was 133,544,000 metric tons. A most important consideration was the available surplus left for export after home consumption in the chief producing countries had been provided for.

National Importance of Supply

The sources from which our supplies of motor spirit and all other petroleum products were drawn was a matter of vital importance from the point of view of national safety; the whole had to be transported by sea. To-day petroleum products, particularly motor spirit, were essential to military operations, and any country failing to keep up its supplies would be indeed outclassed.

Important as the increase in production of crude oil had been in contributing to an increased output of petrol, the demands could not have been met solely by increased production directly from the crude oil. Producers had turned their attention to increasing the yield of the petrol fraction from the crude oil, with marked success. According to an American authority, Mr. T. A. Boyd, in 1913 the United States produced about 1,100 million gallons of petrol, or naphtha, representing 12·5 per cent. of the crude oil; in 1923 the output was approximately 7,500 million gallons, representing approximately 30 per cent. of the crude. The motor spirit fraction was by far the most important fraction of the crude oil to-day, and to raise the average yield to more than twice what it was ten years ago was a technical advance of the highest importance. The principal contribution to this increased yield had been the extensive introduction of cracking processes, and a second factor was the separation of high grade petrol from casing-head gas, the natural gas accompanying petroleum in many oil fields. Petrol obtained by the ordinary methods of distillation, which were dependent upon evaporating off and condensing the vapours of the lower boiling hydrocarbons, yielded straight petrol. By cutting the distillate at suitable points, a petrol resulted having a certain range of distillation. There was an obvious advantage in making the final boiling point as high as possible (usually it was about 190° C. in the best grade motor spirits), because the yield from any given crude oil would thereby be increased.

Petroleum Motor Spirit

Petroleum motor spirit had undergone very considerable modification in the effort to obtain the largest possible fraction from the crude oil. In 1907–9, for No. 1 petrol, the average percentage distilling below 100° C. was 60 to 70, with a final boiling point of from 125° to 130° C. In 1912 about 40 or 50 per cent. was common below 100° C., with a final boiling point of 150° to 160° C. A number of the best known brands collected this year showed 40 per cent. below 100° C., with final boiling points ranging from about 180° to 190° C. There was, however, a practical limitation with present-day engines to raising the final boiling point, because the " heavy ends " (high boiling fractions) escaped complete combustion and dilution of the lubricating oil in the engine resulted. There were also one or two subsidiary objections to raising the end point unduly. Failing this way of increasing the average yield per gallon of crude oil, recourse had been had to cracking and to the separation of petrol from casing-head gas.

In 1920 Burton the inventor of one of the most widely used processes, had estimated the U.S.A. production of cracked spirit as 750 million gallons, or a little over 16 per cent. of the total ouput. As indicating the important influence of the process on the economics of operating the refineries, Professor Brame said that on May 1, 1924, 35 per cent. of those in which no cracking plants were installed were shut down, but only 10 per cent. of those provided with cracking plants were shut down.

Dealing with the workings of the Cross cracking process, he said that a plant had been in successful operation during the last year at the works of the Medway Oil and Storage Co., at the Isle of Grain, and in March of this year 596,000 gallons of finished spirit were made there. The raw material was a Russian kerosene, and the yield of marketable spirit was 60 to 65 per cent. One of the great drawbacks to plants of this type was that, as a rule, they could not treat anything except petroleum distillates. There was only one type of plant which had been operated successfully on heavy residue oils, namely, the Dubbs plant. Cracking processes had added very materially to the quantity of motor spirit yielded by a crude oil, but their further development must be dependent upon maintaining a sufficient margin of profit.

Cracked spirit was characteristically different from the straight spirit, chiefly in that it contained a fairly high quantity of unsaturated hydrocarbons. These were of at least two distinct types—those which were stable in the light and in presence of air, and those which were unstable. The latter were generally regarded as diolefines, they quickly turned yellow, and formed gummy polymers, and it was very necessary that they should be removed by suitable refining. Unsaturated hydrocarbons of the stable type did not appear to be any disadvantage in a motor spirit, He had run a car on a refined but unblended cracked spirit produced in the Cross plant for 170 miles, and had found that the engine functioned as well as with a good aviation spirit. In general cracked spirit was not used alone, but was blended with straight petrol.

Natural Gas

The other source which had contributed considerable quantities to the total output of motor spirit was natural gas. Where the gas had been directly associated with petroleum, in addition to the not easily liquefied hydrocarbons—methane, ethane and propane—there were present the vapours of the lower boiling constituents of straight petrol. By compression these vapours were liquefied, and constituted the natural gas gasoline, or casing head spirit. In 1911 approximately 2,500 million cubic feet of natural gas was treated, yielding 6,100,000 imperial gallons of spirit; in 1921 well over 500,000 million cubic feet of gas yielded 374,540,000 imperial gallons. The average yield from the gas suitable for treatment in the U.S.A. was from 2·5 to 2·9 imperial gallons per 1,000 cubic feet, and the richest gas yielded 6·6 gallons.

The methods of extraction were (*a*) compression, with cooling; (*b*) washing out the vapours with heavy oils; and (*c*) direct absorption by passing the gases through solid absorbents, such as the activated charcoal developed for use n gas masks. The two latter processes were rapidly taking the most prominent place. The liquid condensed by compression contained a high percentage of very volatile hydrocarbons, and had to be " weathered," to allow these to escape, otherwise excessive pressures would be set up in the containers.

Home Production of Motor Spirit

Home production of motor spirit had been confined practically to the oil shale and coal distillation industries. In 1913 the Scottish shale industry produced about 29,000 tons, equivalent to about 8 per cent. of the home consumption. Production had tended to diminish, and as the consumption of motor spirit had increased tremendously the shale spirit

output in 1922 represented about 2 per cent. of our requirements. There certainly did not appear to be any probability of an increased output from shale until perhaps the very difficult problem of de-sulphurising the oil from the Dorset (Kimmeridge) and Norfolk shales had been solved. The coal distillation industries were, however, capable of adding materially to our requirements, and had already made large contributions.

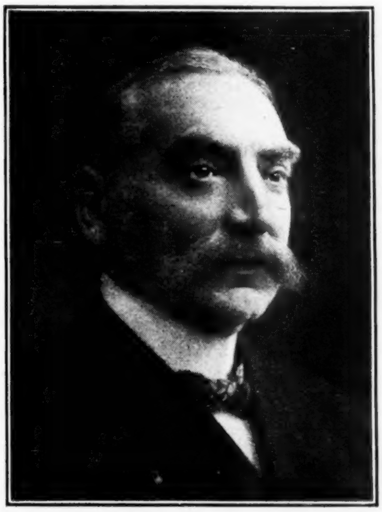
Figures given by the Fuel Research Board (1920) showed that the production in 1918 from gas works was 10,000,000 gallons; and from coke ovens, 32,000,000 gallons. For 1919 the total production was 20 million gallons. Whereas in 1918 gas was being compulsorily stripped of its benzole and toluol, because it was necessary to provide these materials for munitions, in 1919 the stripping had fallen into disuse by gas works. Mr. W. G. Adam, at the World Power Conference last year, gave the quantity of coal carbonised in 1921 as 16,500,000 tons at gas works and 18,000,000 tons at coke oven plants. To-day, with the depression in the steel industry, the amount of coal carbonised for making coke was naturally reduced. The benzole of undefined character produced in 1921 was 14,000,000 gallons, and this, from 34,500,000 tons of coal, was approximately 0·4 gallons per ton. The benzole recoverable from tar had been stated to average 0·2 gallons per ton of coal carbonised. Mr. Adam had given the benzole production in 1918 as 26,400,000 gallons, and had stated that if stripping plant were installed in all gas works, such plant being operated at 66 per cent. recovery, in order not unduly to degrade the gas, the annual production could be increased by 27,000,000 gallons. A reasonable estimate for our possible production would appear to be 45,000,000 gallons. The only independent authoritative tests on a low temperature carbonisation process within Professor Brame's knowledge were those published recently for the Fuel Research Board on the Parker plant at Barugh, Barnsley. The tar yield was 18·62 gallons per ton of coal, and from this a yield of 1·09 gallons of a crude first fraction (boiling up to 170° C.) was obtained. After acid refining and again distilling to 170°, 0·756 gallons of a motor spirit per ton of coal was obtained. By oil scrubbing the gas, 1·78 gallons per ton of crude product was obtained (boiling to 200° C.), and after acid washing and distilling, a refined spirit yield of 1·39 gallons (boiling to 170° C.) resulted. Thus, the total acid-washed and re-distilled spirit amounted to 2·146 gallons per ton.

There was considerable promise that the removal of benzene and its homologues from coal and coke oven gas might be improved by absorption methods, using silica gel or the highly absorbent charcoals, such as were used in gas masks and for absorbing gasoline from natural gas. The use of silica gel had been investigated in the laboratory, and a large plant had been inspected in America by the Benzole Research Committee of the National Benzole Association. The absorption efficiency was 95 per cent., but the directly recovered benzole was not of good colour. By simple further treatment, involving distillation, the overall efficiency was 80 to 82 per cent. The freezing point of the benzole, however, was too high (minus 7·3° C.) to comply with the English specification (minus 14° C.). Also, it did not satisfy the sulphuric acid test.

Another important matter was the degree of refining necessary for the motor benzole fraction of the crude coal tar naphtha. For such purposes as the conversion of benzene into nitro-benzene, the first step in the production of aniline, a fairly close fractionation and a fairly drastic acid treatment had been usual. Hydrocarbons other than those of the aromatic series were undesirable for this process, but the presence of paraffin hydrocarbons (as in low temperature naphthas) and unsaturated hydrocarbons were no drawback in a motor benzole, providing the latter were not of so highly unsaturated a character as to produce darkening in colour and the formation of gummy products on keeping. Simpler methods of refining, with consequent material reduction in the refining losses, were, therefore, possible where the product was destined for use as a motor fuel. In all probability the use of sulphuric acid would prove unnecessary, as had been demonstrated with petroleum spirits and kerosene, and filtration through calcined bauxite, charcoal, or silica gel might be found satisfactory, although the latter had been abandoned for treating the cracked spirit produced by the Cross plant at the Isle of Grain.

Death of Mr. Walter Waugh

THE death at Chigwell Hall, Chigwell, Essex, of Mr. Walter Waugh, chairman of Walter Waugh and Co., Ltd., chemical merchants, etc., of 4, Lloyds Avenue, London, E.C.3, removes one of the best-known and most respected personalities in the British chemical trade. His courtesy and genial social qualities secured for him a wide circle of personal friends, while his industry, administrative ability, extensive knowledge, and sound judgment were recognised and esteemed by all who had commercial relations with him. His death, at a time when his health and mental activity showed scarcely a sign of decline, will be sincerely mourned throughout the industry.



THE LATE MR. WALTER WAUGH

Mr. Waugh was in his 64th year, and had only been ill for a few days. His successful business career is a remarkable tribute to the enterprise and industry of one who had risen to a foremost position in the chemical world. His business activities first found scope in his position as a clerk in the firm of Blagden Angus and Co., later W. G. Blagden and Co., and it is sufficient tribute to his early work to record that he later established himself in partnership with a son of Mr. W. G. Blagden under the title of Blagden, Waugh and Co. This business was dissolved at the end of 1917, and he then founded the firm of Walter Waugh and Co., which on January 1, 1924, became a limited company. The present prosperity and ever growing dimensions of this firm are the best possible records of his success. Mr. Waugh was also connected with the Sulphate of Ammonia Federation, was a director of the Dominion Tar and Chemical Co., Ltd., London, and treasurer of the British Chemical and Dyestuff Traders Association, Ltd. It can safely be said that Mr. Waugh was one of the foremost authorities on pitch and on the coal tar trade in general. He was a pioneer in the pitch and tar industry, and his almost unrivalled experience in this sphere led to many demands upon him in various ways, especially in arbitration matters, where his fairness and conciliatory spirit were most usefully employed.

Two sons, Mr. W. C. Waugh, M.B.E., and Mr. F. A. Waugh remain in the business as directors, together with Mr. E. V. D. Osten.

Humidity Tables

"PRACTICAL HUMIDITY TABLES" for engineers, textile manufacturers, etc., compiled by the technical staff of A. B. Cleworth and Co., Ltd., and published by Taylor and Francis (6s.) are based on Professor Glaisher's "Hygrometrical Tables" and are intended to meet the requirements of various trades whose products are affected by atmospheric variations. The tables have been converted into the metrical system in the hope that they may be of value to continental as well as British users.

The British Association of Chemists

The "Commercial Side"

THE British Association of Chemists possesses an employments bureau which has been of the greatest benefit to many of its members, and employers continually approach the Association in order to fill posts that they may have vacant.

Although conditions are now improving, unemployment among chemists has unfortunately been rife, and it is therefore particularly interesting to consider by what means increased facilities for employment might be obtained.

For many years the profession of engineering has possessed a "commercial side." It has been recognised that technical ability is a very valuable asset where the question of sales is concerned, and in many cases it has been proved to be absolutely essential to satisfactory business negotiations in connection with sales. In the chemical industries, however, the employment of chemists in this capacity is rare, but we venture to think that were they more frequently employed upon the commercial side that both the profession and the industry would benefit.

There are numerous cases in which articles have not been sold simply because the vendor has not been able—through the mouth of his representative—properly to state his case. In the sale of scientific apparatus and of chemicals, the learning fo a set formula will not suffice, and a chemist who is a prospective buyer is much more likely to do business with another chemist than with one whose technical knowledge he will quickly discover to be weak or altogether absent. In the matter of the buying of chemicals this is especially true; many large orders for chemicals have been lost or gained by the presence or absence of a technical representative.

Of late, however, there are some firms who have employed chemists in this capacity with, we believe, the most happy results, and it is definitely our opinion that were greater numbers thus employed the interests both of the industry and the profession would be furthered. The chemist knows too little of business and of the business man, and the business man, for his part, does not understand the chemist. By this means they would more closely co-operate to their common advantage.

That chemists are not more widely employed in commerce has been largely due to their own somewhat unreasonable prejudice. There is a tendency to regard commerce as inferior to science, and to imagine that it does not call for the exercise of those faculties of imagination and logical inference which some have, quite wrongly, held to be the prerogative of science alone. The business man, therefore—and not without some reason—has been inclined to regard the chemist as an impractical dreamer, a point of view which has seriously retarded the progress both of science and industry. We would appeal to all chemists to reconsider their opinions in this matter, and to do all that is possible to bring about an increasingly sympathetic understanding between the industrialist and the scientist.

We would further appeal to all employers to try the experiment of making an increased use of the technical representative, since it is our conviction that in a short time the trained chemist can do all that a commercial representative can do and more. Through its employments bureau the Association is able to supply suitable candidates for this purpose, and recourse to its assistance in such matters would not be had in vain.

All inquiries concerning the Association should be addressed to the General Secretary, The British Association of Chemists, "Empire House," 175, Piccadilly, W.1. H. T. F. R.

Asphalt from Refuse

WOOLWICH Borough Council has recently installed a special plant which converts house refuse into an asphalt. The plant, which cost £4,000, is said to be the only one of its kind in the world. Every conceivable sort of refuse and rubbish, excepting tins and other metal articles, is fed into huge furnaces, which produce clinker. This clinker is then crushed by machinery, which also grades, dries, and heats it to the requisite temperature for mixing with bitumen. The conversion of the clinker into asphalt takes only a few minutes, and 24 hours after the asphalt has been laid the surface is ready for the heaviest traffic. It is stated that as a result of the setting-up of this plant the Borough Council's estimate for the purchase of road-making material for the next year has been reduced by £2,000.

American Exposition of Chemical Industries

(FROM A NEW YORK CORRESPONDENT.)

THE growing importance of the chemical industry to the economic life of the nation will be emphasised at the Tenth Exposition of Chemical Industries to be held during the week of September 28-October 3 next, at the Grand Central Palace, New York City. Plans are already under way to have this Exposition embody the essential features of the present status of the industry. The latest developments in production methods, the most efficient equipment, as well as the fundamentals of the industry are to be there for inspection, as incentives to progressive manufacturers for thoughts and new ideas on the conversion of the raw materials into finished products.

Applied chemistry and engineering in view of improving the quality, increasing the production, and lowering the cost to meet competition will constitute one of the dominant notes at the Exposition. Great efforts are being made to improve and enlarge its scope by making it a truly representative display of products of the American chemical industry, to create public confidence and goodwill for the industry, which is essentially the keynote of the Exposition, and to foster constructive relations between producers and consumers.

Since 1915, when the first Exposition of Chemical Industries was held, much has been learned regarding the best means to give real service to exhibitors and visitors; the subsequent eight expositions have shown clearly the normal progressive steps followed in this direction; the tenth Exposition will be under the same management as all the previous nine expositions, and this important factor warrants the statement that the coming Exposition will embody the best that has been learned by experience.

At first a small collection of what eighty-three exhibitors could show in 1915 of American chemical industries, this national exposition has grown to be the most convenient and representative show place of the steadily increasing chemicals and chemical equipment industries. The exhibits of more than 400 exhibitors at the Ninth National Exposition of Chemical Industries, besides illustrating the sound foundations of the American chemical industries, gave an insight into the wealth of the indigenous raw materials needed by the industry, has embodied manifest proofs of the importance of the Exposition as a testimonial to the great progress in production and quality of American chemicals and chemical equipment, as an educational institution, as the most stimulating factor for creating business relations between producers and consumers, and as the best medium of gaining goodwill for our national industries.

It is evident that the scope of the Exposition has to be broadened many steps further, just as evident as the need of the ever-progressive march of the industry it represents. This is the guiding spirit animating the intimate and creative co-operation of the Advisory Committee of the Exposition with the managers. Among the many outstanding steps in the scope of the Tenth Exposition of Chemical Industries, the one which will give lasting educational results is the institution of a "Court of Chemical Achievement," plans of which were inaugurated at a recent meeting of the Advisory Committee of the Exposition and heartily welcomed by the management. Achievements related to the chemical industry, whether in pure research or industrial research fields, will be given deserved attention by a specially appointed Committee of Approval of the American Chemical Society, and those considered meritorious will be prominently displayed in the form of small unit exhibits grouped together in a specially arranged "Court of Achievements."

At a recent meeting of the Executive Committee of the American Section of the Society of Chemical Industry it was decided that the Section should hold a special meeting during the week of September 28 to October 3, in conjunction with the Exposition. Invitations will be sent to the parent society in England and the Canadian Section of the society to take part in the meetings and in the banquet to be given.

The management of the Tenth National Exposition of Chemical Industries, Grand Central Palace, New York City, will be glad to give full details of any of its work in which readers are interested.

From Week to Week

A SECTION OF THE INSTITUTE OF CHEMISTRY is to be formed at the Cape of Good Hope.

MR. W. J. PARKER, works manager of the Salt Union, Ltd., at Winsford, has been appointed a Justice of the Peace for Cheshire.

GERMAN IMPORTS INTO NEW SOUTH WALES during December last included synthetic dyes valued at £1,060, and fertilisers valued at £1,340.

THE PHOSPHATE INQUIRY COMMITTEE will continue to take evidence on Monday, April 27, and on April 28, 30, and May 1 if necessary.

PRINCETOWN UNIVERSITY, N.J., is to erect a new chemistry building at an estimated cost, including equipment, of over $1,000,000.

DR. S. JUDD LEWIS, who received the Gold Research Medal of the Worshipful Company of Dyers for 1921-22, has received a Bar for 1923-24.

GERMAN BROMIDE PRODUCERS have agreed to a price convention which is fixing prices higher than market value. American demand has fallen off and prices on the market are too low to pay production costs.

JAPANESE IMPORTERS estimate that sulphate of ammonia to be imported into Japan during the first half of this year will total 103,610 tons, a decrease of 29,571 tons on the actual figures during the corresponding period of 1924.

APPLICATIONS ARE INVITED for the following appointments :—Demonstrators in physics and organic chemistry respectively at Bedford College for Women, Regent's Park, London, N.W. (The Secretary, before May 2); assistant professor of chemistry (Egyptian) at the Cairo School of Medicine (The Director, by May 31).

A PRESENTATION was made last week to Mr. Reginald R. Wright, engineer at the Marsh Works of the United Alkali Co., Ltd., on his transfer to the ammonia soda works of the company at Fleetwood. The presentation, subscribed by the engineering office, laboratory, and staffs, took the form of a grandfather clock with chimes.

THE EIGHTH OF THE PUBLIC LECTURES on " Physics in Industry " being delivered under the auspices of the Institute of Physics will deal with " Physics in the Rubber Industry with Special Reference to Tyre Manufacture." The lecture will be given by Dr. W. Makower in the Rooms of the Royal Society, Burlington House, London, on Wednesday, April 29, at 5.30 p.m.

JAMES GORDON AND CO., LTD., Windsor House, Kingsway, London, W.C.2, write :—" In view of some misunderstanding that may be caused through statements that have been made, we shall be glad if you will give publicity to the fact that we are now acting as successors to the late Major S. Utting for the sale of the Thermix Air Heater and Emile Prat Systems of Mechanical Draught."

LORD LEVERHULME'S recent tour has been filmed and the film was shown at a Brussels Exhibition on Thursday. King Albert attended, also Lord Leverhulme and leading representatives of Belgian colonial interests. The film illustrates the creation of the modern palm oil industry. Lord Leverhulme and the Hon. W. Hulme Lever dined later with the King and Queen at the palace.

THE HILLCREST OIL CO. (BRADFORD), LTD., of Victoria Works, Clayton, Manchester, state that they have taken over an additional works and storage, now known as Ocean Oil Works, Miles Platting. There is additional storage for some 2,000 tons of stearines, oleines, fatty acids, etc., and the firm will now be in a position to execute all orders with promptitude as they will be carrying much larger stocks than heretofore.

IMPORT COSTS OF POTASH for American farmers have been lowered rather than increased, as a result of the combination of French and German potash interests. A ton of muriate of potash which cost the American fertiliser manufacturer $32 to $35 in 1913 will cost him $31.10 in 1925, according to the president of the Potash Importing Corporation of America. Prices as announced in Germany show advances in manure salts to $11.00 for 20 per cent. and $17.50 for 30 per cent. with other prices unchanged at $34.55 for the muriate, $45.85 for the sulphate, $7.75 for the kainit, and $26.35 for the double potash and magnesium sulphate.

THE FOURTH ANNUAL COSTING CONFERENCE of the Institute of Costs and Works Accountants will be held at the Hotel Great Central, Marylebone Road, London, N.W., on Friday May 1 next. Lord Leverhulme will open the proceedings. At the morning session the chair will be taken by Sir Edgar Sanders, and a paper will be given on " Cost Accounting in relation to Industrial Policy especially having regard to the Trend towards Price Control," by Messrs. S. L. Gill and D. L. Moran. At the afternoon session the chair will be taken by Sir Herbert Austin, and a discussion on " Budgetary Control " will be opened by Messrs. Perry Keene and F. T. Quennell.

SODIUM NITRITE is a successful substitute for sodium or potassium nitrate in meat curing, according to United States research workers.

FIVE FATAL ACCIDENTS were recorded in the chemicals, etc., industries during March, and 4 in the clay, stone, glass, etc., industries.

JOHN WALKER AND CO., sugar refiners, of Greenock, have purchased the sugar refinery of Neill, Dempster and Neill at Greenock.

A HOME OFFICE INQUIRY is at present taking place in the pottery industry with regard to silicosis, a dangerous disease caused by operatives breathing silica dust.

THE REMOVAL OF EXPORT RESTRICTIONS on olive oil has caused considerable relief in the Spanish industry. The coming crop may generally be considered favourable.

A NEW PROCESS for restoring rusted metal statues is stated to have been invented by Mr. Colin Fink, professor of electro-chemistry at Columbia University, New York.

A CARGO OF SULPHUR ignited in a Swedish steamer off the Humber on Saturday, April 18. The vessel was from America, and efforts at extinguishing proved practically useless.

DYE EXPORTS FROM SWITZERLAND to the United States declined sharply during 1924. Then 664,856 lb., valued at $868,611, were imported against 887,924 lb. valued at $1,189,513 in 1923.

UNEMPLOYED INSURED WORKERS in chemicals, etc., industries in March totalled 8,178—6,683 men and 1,495 women. This total figure represents 8·3 per cent. unemployed and is a slight decrease compared with the previous month.

COLONEL WILLEY, President of the Federation of British Industries, has arrived in Poland. He intends investigating the textile industry in the Lodz district and the possibilities of an extension of British enterprises in that connection.

DISEASES OF OCCUPATION recorded during March included one case of carbon bisulphide poisoning and two of aniline poisoning. Lead poisoning furnished 37 cases; and cases of epitheliomatous ulceration included pitch, 2 ; tar, 2 ; paraffin, 2 ; and oil, 5.

APPLICATIONS FOR A MOSELEY RESEARCH STUDENTSHIP for experimental research in Pathology, Physics, and Chemistry or other sciences are invited by the Royal Society. The studentship is valued at £300 a year for two years and forms can be obtained from the Assistant Secretary, Royal Society, Burlington House, London, W.1.

THE FEDERATION OF BRITISH INDUSTRIES has appointed a committee to inquire into the question of alternate methods of relieving unemployment by devoting dole money to subsidising industry. The members include: Chemical trade, Sir Max Muspratt, Sir Alfred Mond, Mr. W. J. U. Woolcock ; Oils and fats, Sir Edgar Sanders ; and Glass, Sir Ernest Oldham.

SIR ERNEST BENN has acquired from the Hon. Ralph Shirley the controlling interest in W. Rider and Son, Ltd., publisher of the *Timber Trades Journal* and numerous subsidiary publications. Mr. Shirley and Mr. P. S. Wellby have retired from the board, their places being taken by Sir Ernest Benn, who becomes chairman, and Mr. H. P. Shapland, A.R.I.B.A., one of the managing directors of Benn Brothers, Ltd.

H.M. TRADE COMMISSIONER IN NEW ZEALAND, Mr. N. F. Elmslie, will be in attendance at the Department of Overseas Trade for about three weeks from April 27 for the purpose of interviewing British manufacturers and merchants interested in export trade in New Zealand. Interviews by appointment. Reference 5739 T.G., Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

THE BRITISH SCIENCE GUILD, founded in 1905 by the late Sir Norman Lockyer to promote the application of scientific method to social problems and public affairs, held its annual meeting on Tuesday in London. Sir William Bragg spoke on increasing the knowledge of science among the public, and Major H. Fletcher Moulton, chairman of the Research and Invention Committee, said that it was no good telling a commercial man that one method was better than another unless they could show that it was going to be of benefit commercially. There was a big gulf between the man working in the laboratory and the business man applying old methods. There should be someone to go between them, and that was where their Guild came in. Germany was far more ahead of us in that respect than in actual scientific research.

Obituary

Mr. Joshua Hacking, J.P., at Clayton-le-Moors, on Wednesday, aged 79. He was head of the East Lancashire Soap Co., Ltd., and President of the Blackburn Chamber of Commerce.

Mr. George Pilkington, county magistrate, of Widnes. He was for many years a prominent figure in the chemical trade and his Widnes works were taken over by the United Alkali Co., Ltd. He was in his 85th year and had been living in retirement for some years.

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Abstracts of Complete Specifications

230,877. TITANIUM SALTS, PRODUCTION OF PREPARATIONS OF. Peter Spence and Sons, Ltd., H. Spence, W. B. Llewellyn and S. F. W. Crundall, Manchester Alum Works, Holland Street, Manchester. Application date, October 11, 1923.

Solutions of mineral acid salts of titanium sesqui-oxide are powerful reducing agents, and are used for stripping or discharging dyes from textiles, when the dye is reduced and the titanium salt oxidised to titanium dioxide. The object of this invention is to prevent the precipitation of the titanium oxide on the material. This is effected by the presence of some organic acids or salts in the proportion of about one quarter of the mineral acid. Suitable acids are citric, tartaric, oxalic, lactic, and succinic acids, and sodium citrate. The organic acid may replace a proportion of the mineral acid in the preparation of the titanous solution, or it may be subsequently added. The titanous salt may be prepared as a concentrated solution, or it may be evaporated to a solid or semi-solid. If some aluminium sulphate is previously added, the product is less liable to oxidation when kept. Alternatively, solid mineral acid titanous salt, *e.g.*, titanous sodium sulphate, may be prepared, and solid citric or oxalic acid or sodium citrate or oxaliate subsequently added. Reference is directed in pursuance of Section 7, Sub-section 4, of the Patents and Designs Acts of 1907 and 1919, to Specifications Nos. 19,117/1910 and 9,847/1901.

230,910. OXIDE OF IRON, MANUFACTURE OF. C. Monnet, 40, Rue Blanche, Paris. Application date, December 18, 1923.

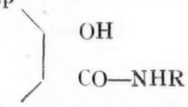
The process is for the manufacture of the anhydrous oxide of iron which is used for polishing metals, and in the manufacture of varnish, paints, or pigments. Ferrous hydrate suitable for the production of the iron oxide is obtained by electrolysing a solution of a neutral salt or of an alkali or alkaline earth salt using electrodes one of which is composed of iron and another of platinised carbon. This yields a ferrous salt and a base which will react to produce ferrous hydrate and regenerate the initial salt. The electrolysis may be performed with or without a diaphragm, and the reaction on the ferrous salt may take place in the electrolytic cell, or in a separate vessel. Sodium chloride constitutes a suitable electrolyte, and it is regenerated in the production of the ferric hydroxide. The polarisation due to the formation of hydrogen at the cathode may be counteracted by the use of a liquid, solid, or gaseous oxidising agent; thus the platinised carbon electrode may be made porous to allow air or oxygen to be blown through. The use of an external current for the electrolysis may be avoided by connecting the two electrodes together so as to constitute a primary cell, which generates the necessary current. The ferric hydrate is separated, washed, and incinerated.

230,916. ALUMINIUM MATERIALS, METHOD FOR THE EXTRACTION OF. H. Wrigley, Alum Works, Manor Street, St. Helens, Lancs. Application date, December 19, 1923.

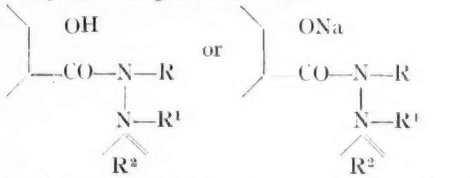
This method is for extracting alumina from substances which do not disintegrate under the action of acid when in small fragments. Such materials are shales, fireclays, blaes, etc. It is possible to treat material which contains a large proportion of fines, *e.g.*, 40-50 per cent. The material is crushed so as to pass through a screen having 6-8 meshes per linear inch, in which case 40-50 per cent. will pass through a screen having 20 meshes per linear inch. In carrying out the invention, the material is placed in a vessel having a false bottom two to three feet above the bottom, and is extracted first with highly neutralised sulphuric acid, then with partly neutralised acid, and finally with fresh acid. The neutralised liquid from the first extraction, having a concentration of 55-65° Tw., is run into a settling tank, and the clear liquor is then decanted for concentration and crystallisation.

230,920. AZO DYESTUFFS AND INTERMEDIATE PRODUCTS, MANUFACTURE OF. British Synthetics, Ltd., and E. B. Higgins, Imperial House, Kingsway, London. Application dates, December 19, 1923, and September 16, 1924.

It is known that colours produced from arylamide of orthocarboxy substituted phenols and naphthols, particularly those containing the group



where R is a simple or substituted benzene or naphthalene group, have advantages in brightness of colour and fastness over those produced from simple phenols or naphthols, but the above arylamides give alkaline solutions which oxidise rapidly and produce azo colours on the fibre which are not fast to rubbing. It is now found that if in such arylamides the labile hydrogen of the group is replaced by the residue of a quarternary ammonium base of the aromatic heterocyclic series, the above disadvantages are avoided. These new substances may have the general formulæ



in which R is a simple or substituted benzene or naphthalene radicle, R¹ is an alkyl or arylkyl radicle or hydrogen, and R² is the hydrocarbon residue of a compound of the heterocyclic aromatic series. Different compounds can be obtained by tautomeric changes, and examples are given of the production of two distinct mono-acetyl compounds by varying the conditions. Examples are given of the manufacture of an alkyl pyridinium compound of an arylide of 2:3-oxynaphthoic acid, in which the corresponding pyridine alkyl halide is treated with a salt of the arylide of 2:3-oxynaphthoic acid. Also the manufacture of an acyl pyridinium compound of an arylide of 2:3-oxynaphthoic acid in which excess of pyridine reacts with the o-acyl compound of the arylide of 2:3-oxynaphthoic acid.

230,968. NITRO DERIVATIVE OF CHLOR-HYDROXYTOLUENE, MANUFACTURE OF. W. H. Webber, F. S. Brightmore, and A. G. Bates, 33, Furnival Street, Holborn, London, E.C.4. Application date, February 16, 1924.

The mono nitro derivative of 1-methyl 2-hydroxy 5-chlorbenzol is prepared by sulphonating the latter and mixing this derivative with a solution of sodium nitrate. A yield of 97 per cent. is obtained. This substance has a melting point of 108° C., and is found to be a good preventative of dry rot in wood.

231,018. PHOSPHO-NITROGENOUS FERTILISER. G. Garbin and S. Toniolo, 24, Via Pr. Umberto, Milan, Italy. Application date, April 24, 1924.

In this invention, a fertiliser containing 10-25 per cent. of nitrogen and 10-25 per cent. of phosphoric anhydride is obtained by mixing phosphorites reduced to colloidal fineness with ammonium nitrate and/or urea. The fertiliser may be obtained by mixing the finished dry products, by mixing an aqueous suspension of the colloidal phosphate with ammonium nitrate solution, by dissolving ammonium nitrate in an aqueous suspension of colloidal phosphate, or by adding the dry colloidal phosphate to a solution of ammonium nitrate. The water content may be regulated to produce a paste which is diluted with water before use.

231,021. FERTILISER. A. S. G. Telfer, The Priory, Harlesden Road, Willesden, London, N.W.10. Application date, May 3, 1924.

This fertiliser is composed of ammonium phosphate 6 parts, ammonium sulphate 4 parts, sodium nitrate 4 parts, potassium nitrate 4 parts, calcium carbonate 2 parts, ammonium nitrate 2 parts, potassium carbonate 2 parts, and kainit 1 part.

231,120. ALBUMEN DYESTUFFS OR COMPOUNDS, PRODUCTION OF. P. C. Rushen, London. From Haco Ges., A.G., Bern, 4, Schanzenstrasse, Berne, Switzerland. Application date, June 21, 1924. Addition to 230,404.

Specification 230,404 (see THE CHEMICAL AGE, Vol. XII, p. 363) describes the production of chlorinated, brominated,

and iodised compounds of albuminous bodies with methylene blue which are used for therapeutic purposes. In this invention similar methods are employed for the production of compounds containing thiazine dyestuffs in which the latter are reduced to the respective leuco compounds and fixed by the albumen in this form. The albuminous substance may be treated directly with an iodine or bromine derivative of the thiazine dyestuff, or the albumen thiazine dye compound can be converted into an iodine or bromine derivative by treating with a salt of iodine or bromine. In an example, dry yeast is suspended in water and heated to 60–70° C., indochromine R R is added, and the mixture kept warm for 30 minutes. The albumen dyestuff is heated to isolate it by coagulation, oxidised by air, separated, and dried.

NOTE.—Abstracts of the following specifications, which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention :—206,121 (G. Gane) relating to treatment of crude petroleum and other hydrocarbons to increase the yield of lighter products, see Vol. X, p. 18 ; 208,713–4 (Aluminum Co. of America) relating to electrolytic refining of aluminium and other metals, see Vol. X, p. 20 (Metallurgical Section) ; 209,723 (Soc. of Chemical Industry in Basle) relating to manufacture of azo dyestuffs, see Vol. X, p. 277 ; 209,771 (K. Fuchs) relating to the fractional condensation of mineral oils and the like in a series of column-like dephlegmators, see Vol. X, p. 300.

International Specifications not yet Accepted

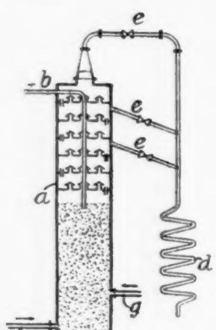
229,236. SEPARATING GASEOUS MIXTURES. E. Urbain, 30, Avenue de l'Observatoire, Paris. International Convention date, February 13, 1924. Addition to 218,974.

In the separation of gases by means of absorptive material as described in specifications 218,974, 227,405 and 228,094, the absorptive material is heated by indirect heating, and simultaneously dried by passing a stream of gas through it. The gases to be treated may be used provided absorption is good at this temperature, otherwise air may be used.

229,253. VULCANISING INDIARUBBER. G. Bruni, 55, Corso Buenos Aires, Milan, Italy. International Convention date, February 15, 1924.

An example of a rubber mixture employing an arylaminothiazole as a vulcanizing agent comprises rubber 100 parts, sulphur 8 parts, zinc oxide 10 parts, anilinobenzothiazole 1 part. This vulcanizes in 40 minutes at 144° C. Homologues may be used which contain lateral groups in the benzene nucleus or in the benzothiazole.

229,272. ALCOHOL, ETHER, AND AMMONIUM SULPHATE. Compagnie de Bethune, Bully-les-Mines, Pas-de-Calais, France. International Convention date, February 11, 1924.



229,272

A heat insulated column *a* is partly filled with broken material, and ethyl sulphuric acid is run on to it from a pipe *b*. Water vapour enters by the pipe *f*, and reacts with and distils the ethyl sulphuric acid. The upper part of the column forms a dephlegmator, and the condensed water is returned while alcohol and ether vapours are drawn off by pipes *e* to the condenser *d*. Liquid of predetermined concentration in alcohol and ether may be obtained from the side pipes. The residual acid may be fixed as ammonium sulphate by introducing ammonia through the pipe *g*.

229,282. PHOSP ORUS AND PHOSPHORIC ACID. Chemische Fabrik Griesheim-Elektron, 31, Gutleutstrasse, Frankfort-on-Main, Germany. International Convention date, February 11, 1924.

When producing phosphorus in an electric furnace, the gases are passed through a heated electrical dust precipitator, which does not condense the phosphorus. Phosphorus subsequently condensed under water is then free from sludge. If air is admitted after removal of dust, phosphorus is burned, and phosphoric acid obtained by condensation in water.

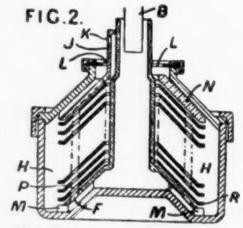
229,283. PURIFYING OILS. Metallbank und Metallurgische Ges. Akt.-Ges., 45, Bockenheimer Anlage, Frankfurt-on-Main, Germany, and W. Gensecke, 87, Homburgerstrasse, Bad Homburg-on-Höhe, Germany. International Convention date, February 15, 1924.

When purifying fats and oils by soda, the lye is concentrated during the neutralization process by reduction of pressure which vaporises part of the water.

229,284. CENTRIFUGAL SEPARATORS. Aktiebolaget Separator, 8, Fleminggatan, Stockholm. International Convention date, February 15, 1924.

The separator has two bottom discs for employment with different liquids. For separating liquids, the mixture enters by the tube B, and through the passages F, M, and the two liquids are discharged at K and L. If there is only one liquid for continuous discharge, the construction is as shown on the right hand side of the diagram. The lowest disc R is not perforated, and the top disc N has no neck. Slime remains in the space H.

FIG.2.



229,284

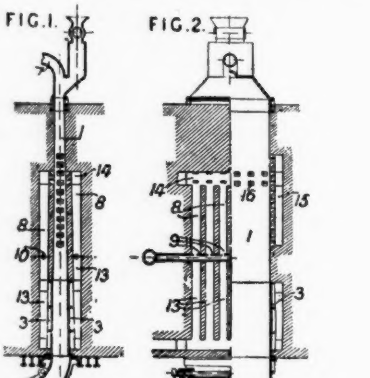
229,298. ETHYL CHLORIDE. H. Suida, 12, Hamerlinggasse, Mödling, Lower Austria. International Convention date, February 11, 1924.

Ethylene and hydrogen chloride react to produce ethyl chloride when under pressure and at a temperature below 50° C. and in the presence of the anhydrous chlorides of aluminium, antimony, chromium, iron, cobalt, magnesium, manganese, nickel, titanium, zinc, and tin. The double compounds of the cholrides with ethylene may also be used. In an example, ethylene and hydrogen chloride react in a steel autoclave containing ferric chloride. The pressure is 30 atmospheres and the temperature 10° C. The product is drawn off through an outlet at the bottom.

229,299. DISTILLING SOLID FUEL. G. M. Jaffrennou, 3, Rue du Maréchal Gallieni, Chatou, Seine-et-Oise, France. International Convention date, February 11, 1924.

A retort 1 for distilling coal, lignite, or wood, is heated on

FIG.1. FIG.2.



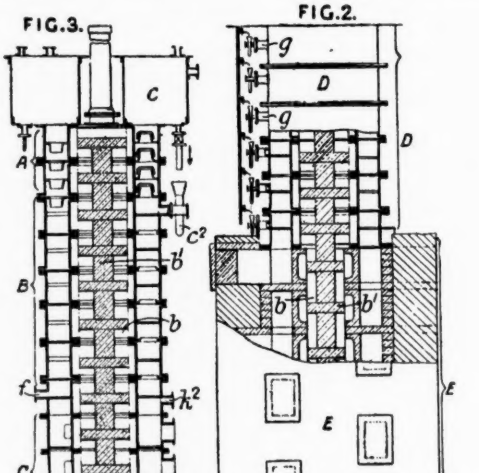
229,299

two sides by flues 8. The coke in the lower part 3 is cooled by the incoming air in the flues 13, and gas is admitted through openings 9 to burn in the flues 8. The hot gases then pass through flues 14, 15, and apertures 16 into the fuel, and the volatile products escape through an outlet 7. The lower part 3 of the retort is of metal.

229,306. DISTILLING OILS AND TARS. J. Pieters, 74, Rue St. Lazare, Paris. International Convention date, February 12, 1924.

Tar is fed from a vessel C through a pipe c^2 below the highest section A of a column. The vapour is separated from entrained liquid in the section A and passes to a condenser. The condensate is freed from water, may be mixed with dehydrated tar leaving the section B by the pipe *f* and re-entering at the top of the section D. Pipes *g* are provided to admit

acetic, hydrochloric, or other acid, or aluminium chloride to the section D. The tar is distilled to dryness in the section E, the vapour rising through section C passing over a catalyst



229,306

such as iron or copper filings. The column is heated by gases from a burner in the base b^2 rising through a central passage b with refractory blocks b^1. Fig 2.

LATEST NOTIFICATIONS.

232,155. Manufacture of cement. Soc. Anon. des Ciments Francais, and Bureau D'Organisation Economique. April 9, 1924.

232,184. Process and apparatus for the manufacture of hydrogen. Compagnie de Produits Chimiques et Electro-Metallurgiques Alais, Froges, et Camargue. April 11, 1924.

232,185. Process for the preparation of a mixture of nitrogen and hydrogen with a view to the manufacture of synthetic ammonia. Compagnie de Produits Chimiques et Electro-Metallurgiques Alais, Froges, et Camargue. April 14, 1924.

232,189. Electrolytic production of aluminium. Aluminum Co. of America. April 10, 1924.

232,206. Manufacture of esters of 4-oxy-piperidine. Standinger, H. April 8, 1924.

232,207. Manufacture of derivatives of 4-oxy-piperidine. Standinger, H. April 8, 1924.

232,230. Manufacture of indigoid dyestuffs containing sulphur. Farbwerke vorm. Meister, Lucius, and Brüning. April 9, 1924.

232,249. Manufacture of disinfecting, bactericidal, insecticidal, fungicidal, and vermin-destroying preparations. Farbenfabriken vorm. F. Bayer and Co. April 10, 1924.

232,251. Manufacture of new azo-dyestuffs. Soc. of Chemical Industry in Basle. April 9, 1924.

232,261. Process of manufacturing chlorinated derivatives of perylene. Pereira, H. April 10, 1924.

232,262. Process of manufacturing dyes. Pereira, H. April 10, 1924.

232,263. Process of manufacturing improved vat dyes. Pereira, H. April 10, 1924.

232,264. Process for manufacturing perylene compounds of quinone character. Pereira, H. April 10, 1924.

232,265. Process of condensing organic compounds by means of aluminium chloride. Pereira, H. April 10, 1924.

232,266. Process of halogenizing perylene. Pereira, H. April 10, 1924.

Specifications Accepted with Date of Application

207,830. Hydrogen cyanide, Manufacture of. Deutsche Gold-und Silber-Scheideanstalt vorm. Roessler. December 2, 1922.

210,750. Gases, Apparatus for the analysis of. G. Roth. February 5, 1923.

211,108. Sulphurized compounds of phenols, Manufacture of. Farbenfabriken vorm. F. Bayer and Co. February 9, 1923. Addition to 173,313.

211,145. Sulphobenzyl ethers of resinous condensation products derived from phenols, Manufacture of. Farbwerke vorm. Meister, Lucius and Brüning. February 7, 1923.

216,882. Low boiling hydrocarbons from hydrocarbons and carbon, Process of preparing. Internationale Bergin-Compagnie voor Olie-en Kolen-Chemie. May 31, 1923.

224,849. Meta aminobenzoyl-meta-aminomethylbenzoyl-1-naphthylamino-4-6-8-trisulphonate of sodium, Manufacture of a symmetrical urea of. Etablissements Poulenc Freres, E. Fourneau, and J. Trefouel. November 14, 1923.

224,223. Magnesium sulphate from raw materials consisting of gypsum and colomite, Manufacture of. Mines Domaniales de Potasse d'Alsace. October 29, 1923.

225,513. Distillation of bituminous substances at low temperatures, Processes for. Kohlenscheidungs Ges. November 28, 1923.

226,824. Hydrogen cyanide, Manufacture of. Deutsche Gold-und Silber-Scheideanstalt vorm. Roessler. December 2, 1922.

230,872. Sulphurised compounds of phenols, Manufacture of. Farbenfabriken vorm. F. Bayer and Co. February 9, 1923.

231,555 and 231,574. Vat dyestuff, Manufacture of. O. Y. Imray. (*Soc. of Chemical Industry in Basle.*) November 29, 1923, and December 31, 1923. 231,574 addition to 231,555.

231,564. Colloids, Process for hardening. A. G. Bloxam. (*Akt.-Ges. für Anilin Fabrikation.*) December 10, 1923.

231,567. Blue vat dyestuffs, Manufacture of. O. Y. Imray. (*Farbwerke vorm. Meister, Lucius, and Brüning.*) December 22, 1923.

231,625. Hydrocarbons, Process for the constructive conversion of heavy to light. W. E. Shore. February 13, 1924.

231,686. Fractional distillation, Process and apparatus for. C. H. Borrmann. May 2, 1924.

231,688. Condensation products of the anthraquinone series, Manufacture of. A. G. Bloxam. (*Soc. of Chemical Industry in Basle, E. Steinbuch and F. Ackermann.*) May 6, 1924. Addition to 205,525.

231,699. 4-amino-2-argentomercaptobenzene-1-carboxylic acid, Manufacture of compounds of, and the alkali salts thereof. W. Carpmael. (*Chemische Fabrik Auf Actien vorm. E. Schering.*) May 30, 1924

231,788. Ammonium sulphate, Manufacture of. H. A. Gill. (*Soc. des Fours à Coke Semet-Solvay et Piette Soc. Anon.*) December 30, 1924.

231,791. Deoderizing fats and oils, Method and apparatus for. H. Bollmann. September 3, 1924.

Applications for Patents

Akt.-Ges. fur Anilin-Fabrikation. Manufacture of ortho-oxyazo-dyestuffs. 10,177. April 18. (Germany, April 19, 1924.)

Badische Anilin- and Soda-Fabrik and Johnson, J. Y. Manufacture of colouring-matters, etc. 9,946. April 16.

Battersby, J. W., Chemical Engineering Co. (Manchester), Ltd., and Spensley, J. W. Separation of fats. 9,801. April 15. (July 16, 1924.)

Battersby, J. W., Chemical Engineering Co. (Manchester), Ltd., and Spensley, J. W. Separation of fats and gelatine from animal tissues. 9,807. April 15. (February, 1924.)

Bloxam, A. G., and Chemische Fabrik Griesheim-Elektron. Manufacture of azo-dyestuffs, etc. 9,829. April 15.

Brown, A. H., and Siluminite Insulator Co., Ltd. Condensation products of phenol, etc. 10,095. April 17.

Carpmael, W. (Pyzel), and Pyzel, D. Distillation of bituminous materials. 9,964. April 16.

Cox, K., and McDermott, P. J. Recovery of benzol, etc., vapours from gas-vapour mixtures. 9,966. April 16.

Fabwerke vorm. Meister, Lucius, and Brüning. Process for dyeing cellulose esters. 9,830. April 15. (Germany, April 15, 1924.)

Forgeur, A., and Grange, L. Manufacture of oxide of zinc. 9,917. April 16. (Belgium, April 16, 1924.)

Helbronner, A., and Pipereaut, P. Manufacture of pigments. 9,961. April 16. (France, April 18, 1924.)

Jansen, H. J. Continuous distillation, etc., of hydrocarbon oils. 10,100. April 17.

Naamlooze Vennootschap Matechu Maatschappij tot Exploitatie van Chemische Vitvindingen. Production of table salt, etc. 10,121. April 18. (Holland, August 2, 1924.)

New Jersey Zinc Co. Manufacture of zinc oxide. 9,732. April 14. (United States, June 17, 1924.)

Pereira, H. Manufacture of chlorinated derivatives of perylene. 9,717. April 14. (Austria, April 10, 1924.)

Pereira, H. Manufacture of dyes. 9,718, 9,719. April 14. (Austria, April 10, 1924.)

Pereira, H. Manufacture of perylene compounds. 9,720. April 14. (Austria, April 10, 1924.)

Pereira, H. Condensing organic compounds. 9,721. April 14. (Austria, April 10, 1924.)

Pereira, H. Halogenizing perylene. 9,722. April 14. (Austria, April 10, 1924.)

Wallace and Tiernan Co., Inc. Production of nitrogen trichloride. 9,862. April 15. (United States, April 21, 1924.)

Wyld, F. Lehnhoff-. Manufacture of organo-metallic compounds of sulpharsenol. 9,948. April 16. (France, April 17, 1924.)

London Chemical Market

The following notes on the London Chemical Market are specially supplied to THE CHEMICAL AGE *by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., and may be accepted as representing these firms' independent and impartial opinions.*

London, April 24, 1925.

TRADE is slowly reopening after the Easter vacation, but on the whole it must be admitted that things are quiet. Stocks of most articles are very light indeed. Price changes are few and far between. The export market is without feature.

General Chemicals

ACETONE.—There has been more inquiry. The price is £75 per ton, ex wharf.

ACID ACETIC is a quiet market. Technical 80% is quoted £39 per ton, and pure 80% £4 per ton.

ACID CITRIC is unchanged at 1s. 5d. per lb. Demand poor.

ACID FORMIC is fairly active and is rather lower in price at £50 per ton for 85%.

ACID LACTIC is in fair demand. The market is firm at £43 per ton for 50%.

ACID OXALIC.—The second-hand stocks are pretty well exhausted. First-hand price is firmly maintained at about 3¾d. per lb.

ACID TARTARIC.—The demand remains disappointing. To-day's quotations are 11¾d. to 1s. per lb.

ALUMINA SULPHATE.—The market is quiet. Prices are nominal.

ARSENIC continues on the down grade owing to the almost complete absence of demand. The market is nominal at £29 per ton, but buyers of quantities could probably do better.

BARIUM CHLORIDE is in fair demand and is quoted at £10 15s. to £11 per ton, ex wharf.

CREAM OF TARTAR is in good demand at £75 to £76 per ton.

EPSOM SALTS is unchanged.

FORMALDEHYDE is rather slow of sale. Price varies between £41 and £44 per ton.

LEAD ACETATE shows signs of firming up again in sympathy with the metal. White is quoted £46, and brown £43 per ton.

LIME ACETATE.—The market is almost dead. There is, however, nothing in second hands and makers' prices are firm at about £15 10s. for grey and £10 15s. to £11 for brown.

METHYL ALCOHOL is lower in price. The prevailing tendency is downwards. Price to-day is £47 to £48 per ton.

POTASH PRUSSIATE.—The improvement in the market has been maintained. Current quotation is 7½d. to 7¾d. per lb.

SODA ACETATE is very quiet. Realisation parcels are on the market at about £21 10s. per ton.

SODA HYPOSULPHITE is without feature.

SODA PRUSSIATE is very quiet, but if anything the price has improved slightly. To-day's quotation is about 4½d. to 4¾d. per lb.

SODA NITRITE is in good demand, and is quoted £22 to £23 per ton, ex wharf.

SODA SULPHIDE is weak, and a further fall in price seems likely.

ZINC SULPHATE is unchanged.

Coal Tar Products

The market generally in coal tar products maintains a steady tone, and there is little fresh business passing.

90% BENZOL is steady at 1s. 9d. per gallon on rails.

PURE BENZOL is quoted at 1s. 11d. to 2s. per gallon on rails.

CREOSOTE OIL is quiet, its value being 6d. to 6¼d. per gallon on rails in the North, while the price in London is quoted at 7d. to 7¼d. per gallon.

CRESYLIC ACID is unchanged, the pale quality 97/99% being quoted at 1s. 9d. per gallon on rails in bulk, while the dark 95/97% quality is quoted at 1s. 7d. to 1s. 8d. per gallon.

SOLVENT NAPHTHA is steady at 1s. 3½d. to 1s. 4d. per gallon on rails.

HEAVY NAPHTHA is also steady at 1s. 1d. to 1s. 2d. per gallon on rails.

NAPHTHALENES are stationary at about £3 15s. to £4 5s. per ton for the lower qualities, while 74/76 quality is quoted at £5 to £5 10s. per ton, and 76/78 at £6 to £6 10s. per ton.

PITCH is unchanged at 40s. to 42s. 6d. per ton, f.o.b. main U.K. ports.

Latest Oil Prices

LONDON.—LINSEED OIL steady at 5s. to 7s. 6d. advance-spot, £46; April, £44 15s.; May-August, £45 5s.; September; December, £44 7s. 6d. RAPE OIL firm; crude, crushed, spot, £49; technical refined, £52. COTTON OIL firm at a further occasional rise of 20s.; refined common edible, £47; Egyptian, crude, £41 10s.; deodorised, £49. Turpentine irregular; American, spot, 70s. 6d., and May, 69s. 6d. per cwt.

HULL.—LINSEED OIL, spot and April, £44 17s. 6d.; May-August, £45; September-December, £44. COTTON OIL, naked, Bombay, crude, £39; Egyptian, crude, £41; edible refined, £44 15s.; deodorised, £46 10s.; technical, £42. PALM KERNEL OIL, crushed, naked, £41 10s. GROUNDNUT OIL, crushed-extracted, £47; deodorised, £51. SOYA OIL, extracted, £40 10s.; crushed, £41; deodorised, £48. RAPE OIL, extracted, £48 per ton, net cash, ex mill. CASTOR OIL and COD OIL unaltered.

Nitrogen Products Market

Export.—During the last month the demand for export has been quiet. It appears that consumers have covered their requirements for this period when it is sown into the soil and any prompt sales now would be too late for sowing. Only about 8,000 tons were sold for prompt delivery and the price remained unchanged at about £13 10s. per ton, f.o.b. U.K. port.

Home.—The home demand continues unabated and producers are disposing of about 600 tons per day. The demand is regular from all parts of the country. Home prices will remain unchanged at £14 14s. per ton, delivered to consumers' nearest station, for neutral quality, basis 21·1 per cent. nitrogen.

Nitrate of Soda.—The nitrate market continues weak, the only bright feature for the nitrate producers being the breakdown of resistance to the price scale of the American cotton planters. The sudden heavy demand from this quarter was not however, sufficient to make any big inroad into the stocks of nitrate in the United States. Cargoes for prompt arrival can be purchased at about £11 11s. per ton, c.i.f., and the arrival of some cargoes unsold tends to keep the price low.

Another weakening feature is the confident prediction in all quarters that the nitrate scale for next season will be much lower. This eliminates any but hand-to-mouth buying.

American Market Movements

(FROM *Drug and Chemical Markets.*)

HEAVY chemical demand still routine with a slight decline reported in contract withdrawals. Barium chloride very weak. Prices show little change. Intermediate market sagging due to dullness. Price shading common with most makers meeting the market. Benzene easy and prices shaded. Other crudes firm and scarce.

Fine chemicals quiet except for rapid advance in Japanese camphor. Quicksilver easier at former prices. Cocaine hydrochloride advanced. Codliver oil easier on large crop. Vegetable oils easy. Chinawood oil dull. Linseed oil unsettled. Coconut oil fairly steady. Animal oils in routine request.

Essential oils are dull. Peppermint prices sagged this week as one or two anxious holders shaded prices to move stocks. Lemon oil is easier on unseasonably small demand. Cassia, anise, and lime oils are scarce. Saffrol and artificial sassafras have been cut sharply in competition.

Weekly Prices of British Chemical Products

The prices and comments given below respecting British chemical products are based on direct information supplied by the British manufacturers concerned. Unless otherwise qualified, the figures quoted apply to fair quantities, net and naked at retailers' works.

General Heavy Chemicals

Acid Acetic, 40% Tech.—£21 to £23 per ton.
Acid Boric, Commercial.—Prices reduced by £5 per ton. Crystal, £40 per ton, Powder, £42 per ton.
Acid Hydrochloric.—3s. 9d. to 6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric, 80° Tw.—£21 10s. to £27 per ton, makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 65s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
Bleaching Powder.—Spot, £10 10s. d/d; Contract, £10 d/d. 4 ton lots.
Bisulphite of Lime.—£7 10s. per ton, packages extra, returnable.
Borax, Commercial.—Crystal, £25 per ton. Powder, £26 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chlorate (Solid).—£5 12s. 6d. to £5 17s. 6d. per ton d/d, carriage paid.
Copper Sulphate.—£25 to £25 10s. per ton.
Methylated Spirit 64 O.P.—Industrial, 2s. 7d. to 2s. 11d. per gall. Mineralised, 3s. 8d. to 4s. per gall., in each case according to quantity.
Nickel Sulphate.—£38 per ton d/d. Normal business.
Nickel Ammonia Sulphate.—£38 per ton d/d. Normal business.
Potash Caustic.—£30 to £33 per ton.
Potassium Bichromate.—5d. per lb.
Potassium Chlorate.—2¾d. to 3d. per lb.
Salammoniac.—£45 to £50 per ton d/d. Chloride of ammonia, £37 to £45 per ton. Carr. pd.
Salt Cake.—£3 15s. to £4 per ton d/d. In bulk.
Soda Caustic, Solid.—Spot lots delivered, £15 12s. 6d. to £18 per ton, according to strength; 20s. less for contracts.
Soda Crystals.—£5 to £5 5s. per ton ex railway depots or ports.
Sodium Acetate 97/98%.—£24 per ton.
Sodium Bicarbonate.—£10 10s. per ton, carr. paid.
Sodium Bichromate.—4d. per lb.
Sodium Bisulphite Powder 60/62%.—£16 to £17 per ton, according to quantity, f.o.b., 1-cwt. iron drums included.
Sodium Chlorate.—2¾d. per lb.
Sodium Nitrate refined 96%.—£13 5s. to £13 10s. per ton, ex Liverpool. Nominal.
Sodium Nitrite 100% basis.—£27 per ton d/d
Sodium Sulphate (Glauber Salts).—£3 12s. 6d. per ton.
Sodium Sulphide conc. solid. 60/65.—About £15 per ton d/d. Contract £14 15s. Carr. pd.
Sodium Sulphide Crystals.—£9 5s. per ton d/d. Contract £9 2s. 6d. Carr. pd.
Sodium Sulphide, Pea Crystals.—£15 per ton f.o.r. London, 1-cwt. kegs included.

Coal Tar Products

Acid Carbolic Crystals.—5d. per lb. Quiet demand. Crude 60's, 1s. 6d. per gall. Little demand.
Acid Cresylic 97/99.—1s. 8d. to 2s. per gall. Fair business. Pale, 95%, 1s. 6d. to 1s. 10d. per gall. Dark, 1s. 6d. to 1s. 9d. per gall. Little demand.
Anthracene Paste 40%.—3d. to 4d. per unit per cwt.—Nominal price. No business.
Anthracene Oil, Strained.—7d. to 8d. per gall. Unstrained, 6d. to 7d. per gall.
Benzol.—Crude 65's.—9d. to 11½d. per gall., ex works in tank wagons. Standard Motor, 1s. 4½d. to 1s. 6d. per gall., ex works in tank wagons. Pure, 1s. 9½d. to 1s. 11d. per gall., ex works in tank wagons.
Toluol.—90%, 1s. 7d. to 1s. 8d. per gall. More inquiry. Pure, 1s. 10d. to 2s. per gall. Steady demand.
Xylol Commercial.—2s. 3d. per gall. Pure, 3s. 3d. per gall.
Creosote.—Cresylic, 20/24%, 8¼d. to 8½d. per gall. Little demand. Middle Oil, Heavy, Standard specification, 6d. to 7d. per gall., according to quality and district. More inquiry.
Naphtha.—Crude, 8d. to 9d. per gall. Solvent 90/160, 1s. 4d. to 1s. 6d. per gall. Demand good. Solvent 90/190, 11½d. to 1s. 1d. per gall. Steady business.
Naphthalene Crude.—Cheaper in Yorkshire than in Lancashire. Drained Creosote Salts, £3 to £5 per ton. Demand falling off. Whizzed or hot pressed. £6 to £9 per ton.
Naphthalene.—Crystals and Flaked, £12 to £15 per ton, according to districts. Very quiet.
Pitch.—Medium soft, 37s. 6d. to 42s. 6d. per ton, according to district. More inquiry for next season. Few sellers.
Pyridine.—90/160, 18s. 6d. to 19s. per gall. Market quieter. Fair demand. Heavy, 11s. to 12s. per gall. Not much inquiry.

Intermediates and Dyes

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acetic Anhydride 95%.—1s. 7d. per lb.
Acid H.—3s. 9d. per lb. 100% basis d/d.
Acid Naphthionic.—2s. 2d. per lb. 100% basis d/d.
Acid Neville and Winther.—5s. 8d. per lb. 100% basis d/d.
Acid Salicylic, technical.—11½d. to 1s. per lb. Price reduced. Improved demand.
Acid Sulphanilic.—9d. per lb. 100% basis d/d.
Aluminium Chloride, anhydrous.—10d. per lb. d/d.
Aniline Oil.—7½d. per lb. naked at works.
Aniline Salts.—8d. per lb. naked at works.
Antimony Pentachloride.—1s. per lb. d/d.
Benzidine Base.—3s. 8d. per lb. 100% basis d/d.
Benzyl Chloride 95%.—1s. 1d. per lb.
p-Chlorphenol.—4s. 3d. per lb. d/d.
p-Chloraniline.—3s. per lb. 100% basis.
o-Cresol 29/31° C.—3d. per lb. Demand quiet.
m-Cresol 98/100%.—2s. 1d. to 2s. 3d. per lb. Demand moderate.
p-Cresol 32/34° C.—2s. 1d. to 2s. 3d. per lb. Demand moderate.
Dichloraniline.—2s. 3d. per lb.
Dichloraniline S. Acid.—2s. 3d. per lb. 100% basis.
p-Dichlorbenzol.—£85 per ton.
Diethylaniline.—4s. 3d. per lb. d/d., packages extra, returnable.
Dimethylaniline.—2s. 2d. per lb. d/d. Drums extra.
Dinitrobenzene.—9d. per lb. naked at works.
Dinitrochlorbenzol.—£84 10s. per ton d/d.
Dinitrotoluene.—48/50° C. 8d. to 9d. per lb. naked at works. 66/68° C. 1s. per lb. naked at works.
Diphenylaniline.—2s. 10d. per lb. d/d.
G. Salt.—2s. 2d. per lb. 100% basis d/d.
Monochlorbenzol.—£63 per ton.
a-Naphthol.—2s. 3d. per lb. d/d.
B-Naphthol.—1s. per lb. d/d.
a-Naphthylamine.—1s. 3½d. per lb. d/d.
B-Naphthylamine.—3s. 9d. per lb. d/d.
m-Nitraniline.—4s. 2d. per lb. d/d.
p-Nitraniline.—2s. 2d. per lb. d/d.
Nitrobenzene.—5½d. to 5¾d. per lb. naked at works.
o-Nitrochlorbenzol.—2s. 3d. per lb. 100% basis d/d.
Nitronapthalene.—10d. per lb. d/d.
p-Nitrophenol.—1s. 9d. per lb. 100% basis d/d.
p-Nitro-*o*-amido-phenol.—4s. 6d. per lb. 100% basis.
m-Phenylene Diamine.—4s. per lb. d/d.
p-Phenylene Diamine.—9d. 9d. per lb. 100% basis d/d.
R. Salt.—2s. 4d. per lb. 100% basis d/d.
Sodium Naphthionate.—2s. 2d. per lb. 100% basis d/d.
o-Toluidine.—10d. per lb.
p-Toluidine.—2s. 3d. per lb. naked at works.
m-Toluylene Diamine.—4s. per lb. d/d.

Wood Distillation Products

Acetate of Lime.—Brown £11. Quiet market. Grey, £15 10s. per ton. Firmer. Liquor, 9d. per gall. 32° Tw.
Acetone.—£78 per ton.
Charcoal.—£7 5s. to £9 per ton, according to grade and locality. Fair demand.
Iron Liquor.—1s. 7d. per gall 32° Tw. 1s. 2d. per gall. 24° Tw.
Red Liquor.—10d. to 1s. per gall. 14/15° Tw.
Wood Creosote.—2s. 9d. per gall. Unrefined.
Wood Naphtha, Miscible.—4s. 9d. per gall. Only moderate market. 60% O.P. Solvent, 5s. per gall. 40% O.P.
Wood Tar.—£4 to £5 per ton. Demand slack and stocks being held.
Brown Sugar of Lead.—£43 10s. per ton.

Rubber Chemicals

Antimony Sulphide.—Golden, 7¼d. to 1s. 5d. per lb., according to quality. Crimson, 1s. 5d. to 1s. 7½d. per lb., according to quality.
Arsenic Sulphide, Yellow.—2s. per lb.
Cadmium Sulphide.—4s. 4d. per lb., according to quantity.
Carbon Bisulphide.—£32 to £35 per ton, according to quantity.
Carbon Black.—6d. to 6½d. per lb., ex wharf.
Carbon Tetrachloride.—£62 to £67 per ton, according to quantity, drums extra.
Chromium Oxide, Green.—1s. 4d. per lb.
Indiarubber Substitutes, White and Dark.—5¾d. to 7¼d. per lb.
Lamp Black.—£48 per ton, barrels free.
Lead Hyposulphite.—9d. per lb.
Lithopone, 30%.—£22 10s. per ton.
Mineral Rubber "Rubpron."—£16 to £18 per ton f.o.r. London.
Sulphur.—£10 to £12 per ton, according to quality.
Sulphur Chloride.—4d. per lb., carboys extra.

Sulphur Precip. B.P.—£56 to £65 per ton.
Thiocarbanilide.—2s. 6d. per lb.
Vermilion, Pale or Deep.—5s. 6d. per lb. Dearer.
Zinc Sulphide.—1s. 1d. per lb.

Pharmaceutical and Photographic Chemicals

Acid, Acetic 80% B.P.—£41 per ton ex wharf London in glass containers.
Acid, Acetyl Salicylic.—2s. 9d. to 2s. 11d. per lb., according to quantity. Market slightly easier.
Acid, Benzoic B.P.—2s. to 2s. 3d. per lb., according to quantity, for synthetic product.
Acid, Boric B.P.—Prices reduced by £5 per ton. Crystal £46 per ton, Powder £50 per ton. Carriage paid any station in Great Britain.
Acid, Camphoric.—19s. to 21s. per lb.
Acid, Citric.—1s. 4½d. per lb., less 5% for ton lots. Slightly upward tendency.
Acid, Gallic.—2s. 9d. per lb. for pure crystal, in cwt. lots. Easier.
Acid, Pyrogallic, Crystals.—6s. per lb. for 1 cwt. lots. 7s. 6d. per lb. for 7-lb. lots, according to quantity. Steady market.
Acid, Salicylic.—1s. 5½d. to 1s. 6d. per lb., according to quantity. Market rather easier.
Acid, Tannic B.P.—2s. 9d. per lb. Quiet steady demand.
Acid, Tartaric.—1s 1d. per lb., less 5%. Very firm. Demand good.
Amidol.—9s. per lb., d/d.
Acetanilide.—1s. 9d. per lb. Price lower owing to competition.
Amidopyrin.—14s. per lb.
Ammonium Benzoate.—3s. to 3s. 6d. per lb., according to quantity.
Ammonium Carbonate B.P.—£37 per ton. Powder, £39 per ton in 5 cwt. casks.
Atropine Sulphate.—12s. 6d. per oz. for English make.
Barbitone.—11s. 9d. per lb. Price lower owing to competition.
Benzonaphthol.—4s. 3d. per lb. spot. Weaker. Demand quiet.
Bismuth Salts.—Prices reduced by about 1s. 3d. to 2s. 3d. per lb. on account of the fall in the price of the metal.
Bismuth Carbonate.—10s. 6d. to 12s. 6d. per lb.
Bismuth Citrage.—10s. 3d. to 12s. 3d. per lb.
Bismuth Salicylate.—9s. to 11s. per lb.
Bismuth Subnitrate.—8s. 8d. to 10s. 8d. per lb. according to quantity.
The price of Bismuth Metal has been raised from 5s. to 7s. 6d. per lb. Bismuth Salts have been advanced accordingly.
Borax B.P.—Crystal £29, Powder £30 per ton. Carriage paid any station in Great Britain.
Bromides.—Potassium, 1s. 11d. to 2s. 1d. per lb.; sodium, 2s. to 2s. 2d. per lb.; ammonium, 2s. 4d. to 2s. 6d. per lb., all spot. Much firmer. Forward prices higher.
Calcium Lactate.—1s. 7d. to 1s. 9d., according to quantity. Fair demand and steady market.
Chloral Hydrate.—3s. 8d. per lb., duty paid.
Chloroform.—2s. 6d. per lb. for cwt. lots.
Creosote Carbonate.—6s. 9d. per lb. Little demand.
Formaldehyde.—£41 per ton, in barrels ex wharf.
Glycerophosphates.—Fair business passing. Calcium, soluble and citrate free, 7s. per lb.; iron, 8s. 9d. per lb.; magnesium, 9s. per lb.; potassium, 50%, 3s. 6d. per lb.; sodium, 60%, 2s. 6d. per lb.
Guaiacol Carbonate.—7s. 6d. per lb.
Hexamine.—2s. 7d. per lb. for cwt. lots.
Homatropine Hydrobromide.—25s. to 30s. per oz.
Hydrastine Hydrochloride.—English make offered at 120s. per oz.
Hydrogen Peroxide (12 vols.).—1s. 8d. per gallon f.o.r. makers' works, naked.
Hydroquinone.—4s. 3d. per lb. Nominal.
Hypophosphites.—Calcium, 3s. 6d. per lb., for 28 lb. lots; potassium, 4s. 1d. per lb.; sodium, 4s. per lb.
Iron Ammonium Citrate B.P.—1s. 11d. to 2s. 3d. per lb.
Magnesium Carbonate.—Light Commercial, £36 per ton net. Light pure, £46 per ton.
Magnesium Oxide.—Light Commercial, £72 10s. per ton, less 2½%, price reduced; Heavy Commercial, £25 per ton, less 2½%; Heavy Pure, 2s. to 2s. 3d. per lb., according to quantity.
Menthol.—A.B.R. recrystallised B.P., 44s. per lb.; April delivery. Synthetic 26s. to 35s. per lb., according to quality.
Mercurials.—Market flat. Mercury slightly firmer. Red oxide, 5s. 2d. to 5s. 4d. per lb.; Corrosive sublimate, 3s. 7d. to 3s. 9d. per lb.; white precipitate, 4s. 6d. to 4s. 8d. per lb.; Calomel, 3s. 10d. to 4s. per lb.
Methyl Salicylate.—1s. 5½d. per lb., for ton lots. Keen competition.
Methyl Sulphonal.—19s. 3d. per lb. Cheaper.
Metol.—11s. per lb. British make.
Morphone and Salts.—Reduced by 1s. to 1s. 3d. per oz.
Paraformaldehyde.—2s. 2d. for B.P. quality. Keen competition has brought prices down.
Paraldehyde.—1s. 2d. to 1s. 4½d. per lb., in free bottles and cases.
Phenacetin.—4s. 8d. per lb. in cwt. lots. Unsettled. Supplies exceed demand.
Phenazone.—6s. 3d. to 6s. 6d. per lb. Spot price lower than forward.
Phenolphthalein.—4s. 6d. to 5s. per lb. for cwt. lots.
Potassium Bitartrate 99/100% (Cream of Tratar).—83s. per cwt., less 2½% for ton lots.
Potassium Citrate.—1s. 10d. to 2s. 2d. per lb.
Potassium Ferricyanide.—1s. 9d. per lb. Quiet.
Potassium Iodide.—16s. 8d. to 17s. 5d. per lb., according to qunatity. Steady market.
Potassium Metabisulphite.—7½d. per lb., 1-cwt. kegs included. f.o.r. London.
Potassium Permanganate.—B.P. crystals, 7½d. per lb., spot; commercial, 8d. to 8¼d. per lb., carriage paid. Slight reaction after recent advance.
Quinine Sulphate.—2s. 3d. to 2s. 4d. per oz., in 100 oz. tins. Steady market.
Resorcin.—4s. 9d. per lb. In fair quantities. Supplies exceed demand.
Saccharin.—63s. per lb. in 50 lb. lots.
Salol.—3s. 6d. per lb., for cwt. lots. Slightly dearer.
Silver Proteinate.—12s. per lb. for satisfactory product light in colour.
Sodium Benzoate, B.P.—1s. 10d. to 2s. 2d. per lb. From natural benzoic acid. Supplies of good quality available.
Sodium Citrate, B.P.C., 1923.—1s. 11d. to 2s. 2d. per lb., according to quantity.
Sodium Hyposulphite, Photographic.—£14 to £15 per ton, according to quantity, d/d consignee's station in 1-cwt. kegs.
Sodium Metabisulphite Crystals.—37s. 6d. to 60s. per cwt., net cash, according to quantity.
Sodium Nitroprusside.—16s. per lb.
Sodium Potassium Tartrate (Rochelle Salt).—75s. per cwt., for ton lots and upwards.
Sodium Salicylate.—Powder, 2s. 2d. to 2s. 3d. per lb. Crystal, 2s. 3d. to 2s. 5d. per lb. Flake, 2s. 6d. per lb. Strong demand, market firmer.
Sodium Sulphide, pure recrystallised.—10d. to 1s. 2d. per lb.
Sodium Sulphite, anhydrous, £27 10s. per ton, minimum 5 ton lots, according to quantity; 1-cwt. kegs included.
Sulphonal.—13s. per lb. accepted for quantity.
Thymol.—15s. to 16s. per lb.

Perfumery Chemicals

Acetophenone.—10s. 9d. per lb.
Aubepine.—11s. 3d. per lb.
Amyl Acetate.—3s. per lb.
Amyl Butyrate.—6s. 6d. per lb.
Amyl Salicylate.—3s. 1½d. per lb.
Anethol (M.P. 21/22° C.).—4s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. 7½d. per lb.
Benzyl Alcohol free from Chlorine.—2s. 7½d. per lb.
Benzaldehyde free from Chlorine.—3s. 1½d. per lb.
Benzyl Benzoate.—3s. 1½d. per lb.
Cinnamic Aldehyde Natural.—16s. per lb.
Coumarin.—14s. 9d. per lb. Again cheaper.
Citronellol.—22s. per lb.
Citral.—10s. per lb.
Ethyl Cinnamate.—10s. per lb.
Ethyl Phthalate.—3s. per lb.
Eugenol.—10s. 6d. per lb.
Geraniol (Palmarosa).—28s. 6d. per lb.
Geraniol.—9s. 6d. to 18s. 6d. per lb. Cheaper.
Heliotropine.—6s. 3d. per lb.
Iso Eugenol.—15s. per lb.
Linalol ex Bois de Rose.—24s. 6d. per lb.
Linalyl Acetate.—24s. 6d. per lb.
Methyl Anthranilate.—10s. per lb.
Methyl Benzoate.—5s. per lb.
Musk Ambrette.—50s. per lb.
Musk Ketone.—42s. 6d. per lb.
Musk Xylol.—11s. per lb.
Nerolin.—4s. 6d. per lb.
Phenyl Ethyl Acetate.—15s. per lb.
Phenyl Ethyl Alcohol.—14s. per lb.
Rhodinol.—40s. per lb.
Safrol.—1s. 8d. per lb. Cheaper.
Terpineol.—1s. 10d. per lb. Cheaper.
Vanillin.—25s. to 25s. 6d. per lb.

Essential Oils

Almond Oil, Foreign S.P.A.—13s. 9d. per lb.
Anise Oil.—2s. 9d. per lb.
Bergamot Oil.—16s. per lb.
Bourbon Geranium Oil.—22s. 6d. per lb.
Camphor Oil.—62s. 6d. per cwt.
Cananga Oil, Java.—11s. per lb.
Cinnamon Oil, Leaf.—6d. per oz.
Cassia Oil, 80/85%.—10s. per lb.
Citronella Oil.—Java, 85/90%, 4s. 10d. per lb. Ceylon, 2s. 10d. to 3s. 1d. per lb., according to quality.
Clove Oil.—7s. 6d. per lb.
Eucalyptus Oil, 70/75%.—2s. per lb.
Lavender Oil.—French 38/40% Esters, 35s. per lb.
Lemon Oil.—3s. 9d. per lb.
Lemongrass Oil.—5s. 9d. per lb.
Orange Oil, Sweet.—11s. 3d. per lb.
Palma Rose Oil.—15s. 3d. per lb.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to* THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, April 24, 1925.

BUSINESS in the heavy chemical market has again been to the quiet side, only a moderate amount of inquiries being received during the past week. Prices on the whole are steady.

Industrial Chemicals

ACID ACETIC.—In moderate demand and prices generally unchanged. 98/100% glacial, £56 to £67 per ton, according to quality and packing. 80% pure, £41 to £43 per ton. 80% technical, £40 to £42 per ton, packed in casks delivered c.i.f. U.K. ports. Some spot parcels of 80% technical quality offered from the continent slightly below the above figure.

ACID BORACIC.—Crystal, granulated, or small flaked at £40 per ton; powdered, £42 per ton, carriage paid U.K. stations, minimum ton lots.

ACID CARBOLIC, ICE CRYSTALS.—In poor demand, and price reduced to 5d. per lb. delivered.

ACID CITRIC, B.P. CRYSTALS.—Unchanged at about 1s. 4½d. per lb., less 5%, ex store, spot delivery. In usual steady demand.

ACID FORMIC 85%.—Unchanged at about £50 per ton, ex wharf, prompt delivery. Offered for prompt shipment from the continent at about £48 per ton, c.i.f. U.K. ports.

ACID HYDROCHLORIC.—In little demand. Price 6s. 6d. per carboy, ex works.

ACID NITRIC, 80°.—Usual steady demand quoted £23 15s. per ton, ex station, full truck loads.

ACID OXALIC, 98/100%.—Rather better inquiry and price unchanged at about 4d. per lb., ex store, spot delivery. Quoted 3¾d., ex wharf for material to come forward.

ACID SULPHURIC.—144°, £3 12s. 6d. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality, 20s. per ton more.

ACID TARTARIC, B.P. CRYSTALS.—Unchanged at about 11¾d. per lb., less 5%, ex store.

ALUMINA SULPHATE, 17/18% IRON FREE.—Quoted £6 15s. per ton, ex store, spot delivery. Offered for prompt shipment from the continent at about £6 5s. per ton, c.i.f. U.K. ports.

ALUM, LUMP POTASH.—Spot lots unchanged at about £9 10s. per ton. Offered for prompt shipment from the continent at £8 5s. per ton, c.i.f. U.K. ports.

AMMONIA ANHYDROUS.—Quoted 1s. 4½d. per lb., ex station. Containers extra and returnable.

AMMONIA CARBONATE.—Lump, £37 per ton; powdered, £39 per ton, packed in 5 cwt. casks, delivered U.K. ports.

AMMONIA LIQUID, 880°.—In steady demand. Unchanged at 2½d. to 3d. per lb., delivered according to quantities.

AMMONIA MURIATE, 880°.—Grey galvaniser's crystals of English manufacture quoted at £29 per ton, ex store. Fine white crystals offered from the continent at about £20 10s. per ton c.i.f. U.K. ports.

ARSENIC, WHITE POWDERED.—Nominally £28 per ton, ex store. Continental material quoted £25 10s. per ton, c.i.f. U.K. ports.

BARIUM CHLORIDE, 98/100%.—English material unchanged at about £10 5s. per ton, ex store. Foreign material on offer at £8 15s. per ton, c.i.f. U.K. ports.

BLEACHING POWDER.—Spot lots quoted £10 10s. per ton, ex station. Contracts 20s. per ton less.

BARYTES.—English material unchanged at £5 5s. per ton, ex works. Continental quoted £5 per ton, c.i.f. U.K. ports.

BORAX.—Remains unchanged. Granulated, £24 10s. per ton; crystals, £24 per ton; powdered, £26 per ton, carriage paid U.K. stations, minimum ton lots.

CALCIUM CHLORIDE.—English makers' price unchanged at £5 12s. 6d. to £5 17s. 6d. per ton, ex station. Continental quoted £3 15s. per ton, c.i.f. U.K. ports.

COPPERAS, GREEN.—Unchanged at about £3 5s. per ton, ex works, packed in casks free.

COPPER SULPHATE.—English material unchanged at about £24 10s. per ton, f.o.b. U.K. port. Continental quoted about £22 10s. to £23 per ton, c.i.f. U.K. ports.

FORMALDEHYDE 40%.—Spot material quoted £42 10s. per ton, ex store. Offered for prompt shipment from the continent at about £40 per ton, ex wharf.

GLAUBER SALTS.—White crystals of English manufacture, unchanged at £4 per ton, ex store or station. Continental on offer at about £3 5s. per ton, c.i.f. U.K. ports.

LEAD, RED.—Imported material unchanged at about £43 per ton, ex store, spot delivery.

LEAD WHITE.—On offer at £44 10s. per ton, ex store.

LEAD ACETATE.—Triple refined white crystals offered from the continent at about £43 15s. per ton, c.i.f. U.K. ports.

LEAD, NITRATE.—Quoted £41 per ton, ex store.

MAGNESITE, CALCINED.—Quoted £8 per ton, ex station, prompt delivery.

MAGNESIUM CHLORIDE.—Quoted £2 15s. per ton, c.i.f. U.K. ports, prompt shipment.

POTASH, CAUSTIC 88/92%.—Unchanged at about £29 per ton, ex wharf, prompt shipment from the continent. Spot material available at about £30 10s. per ton, ex store.

POTASSIUM BICHROMATE.—Price for home consumption, 5d. per lb. delivered.

POTASSIUM CARBONATE 96/98%.—Spot material unchanged at about £25 15s. per ton, ex store. Offered for prompt shipment from the continent at about £25 5s. per ton, c.i.f. U.K. ports.

POTASSIUM CHLORATE.—Spot material unchanged at about 4d. per lb., ex store. Offered for early delivery at 3¾d. per lb., c.i.f. U.K. ports.

POTASSIUM NITRATE, SALTPETRE.—Refined granulated 99% quoted £24 10s. per ton, c.i.f. U.K. ports. Spot material available at about £28 per ton, ex store.

POTASSIUM PERMANGANATE, B.P. CRYSTALS.—Quoted 7¾d. per lb., ex store. Offered for early delivery at 7½d. per lb., ex wharf.

POTASSIUM PRUSSIATE, YELLOW.—Spot material unchanged at about 7½d. per lb., ex store. Offered for early delivery at 7¼d. per lb., ex wharf.

SODA, CAUSTIC, 76/77%, £18 per ton; 70/72%, £16 12s. 6d. per ton. Broken, 60%, £17 2s. 6d. per ton. Powdered, 98/99%, £21 7s. 6d. per ton. All carriage paid U.K. stations, spot delivery. Contracts, 20s. per ton less.

SODIUM ACETATE.—On offer from the continent at about £19 10s. per ton, c.i.f. U.K. ports. Spot material quoted £21 10s. per ton, ex store.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay or station. M.W. quality, 30s. per ton less.

SODIUM CARBONATE.—Soda crystals, £5 to £5 5s. per ton, ex quay or station. Powdered or pea quality, £1 7s. 6d. per ton more; alkali, 58%, £8 12s. 3d. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—English material unchanged at £9 15s. per ton, ex station. Continental quoted £8 10s. per ton, c.i.f. U.K. ports. Spot material of continental manufacture available at about £9 15s. per ton, ex store. Pea crystals of English manufacture unchanged at £14 per ton, ex station.

SODIUM NITRATE.—Ordinary quality quoted £13 7s. 6d. per ton, ex store; 96/98%, refined quality, 7s. 6d. per ton extra.

SODIUM NITRIC, 100%.—Offered from the continent at about £23 per ton, c.i.f. U.K. ports. Spot material available at about £24 15s. per ton, ex store.

SODIUM PRUSSIATE, YELLOW.—Now quoted 4d. per lb., ex store.

SODIUM SULPHATE, SALTCAKE.—Price for home consumption, £3 10s. per ton, f.o.r. works. Good inquiry for export and higher prices obtainable.

SODIUM SULPHIDE.—English manufacturers quote: 60/62%, solid, £15 per ton; broken, £1 per ton more. Flake, £2 per ton more. Crystals, 31/34%, £9 5s. per ton, carriage paid U.K. stations: minimum, 4-ton lots, with slight reduction for contracts over a period. Continental material slightly cheaper; 60/62% solid offered at about £11 per ton, c.i.f. U.K. port. Broken, £12, per ton, c.i.f. U.K. port; 30/32%, crystals, £8 5s. per ton, c.i.f. U.K. ports.

SULPHUR.—Flowers, £9 10s. per ton; roll, £8 10s. per ton; rock £8 7s. 6d. per ton; ground, £8 5s. per ton, ex store. Prices nominal. American crude sulphur on offer at about £5 2s. 6d. per ton, c.i.f. U.K. ports.

ZINC CHLORIDE, 97/98%, of continental manufacture, quoted £23 per ton, c.i.f. U.K. port. English material, for export, on offer at about £25 to £26 per ton, f.o.b. U.K. port.

ZINC SULPHATE.—In moderate demand, and price unchanged at about £12 10s. per ton, ex store.

NOTE.—The above prices are for bulk business, and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

H. ACID.—Home inquiries. Price 3s. 6d. per lb.

SULPHANILIC ACID.—Home inquiries. Price 8½d. per lb.

BETA NAPHTHOL.—Some home inquiries. Price 11d. to 1s. per lb.

PARATOLUIDINE.—Some export inquiries. Price 3s. 2d. per lb.

Manchester Chemical Market

(From Our Own Correspondent.)

Manchester, April 24, 1925.

The movement of chemicals on the Manchester market during the past week has only been on a moderate scale. The continued short-time working in the Lancashire cotton industry is a serious factor so far as the home consumption of chemicals is concerned and there is little indication of an improvement in this direction at the moment. Inquiries for shipment are reported but actual business is quiet. Continental demand is flat, the Dominions and the eastern markets taking the major share of the export trade that is going.

Heavy Chemicals

There has been little change in the position of sulphide of sodium, either in respect of price or weight of business, which continues light; 60-65 per cent. concentrated solid is quoted at £13 15s. to £14 per ton and crystals at round £9 10s. Glauber salts are dull and easy at about £3 10s. per ton. Saltcake is in quiet demand for both branches of trade, but values are unchanged at £4 per ton. Hyposulphite of soda still attracts small attention; quotations are on the easy side at £13 10s. to £13 15s. per ton for photographic crystals and £9 per ton for commercial quality. Caustic soda keeps firm and in fair demand both for home use and for shipment; values range from £15 12s. 6d. per ton for 60 per cent. material to £18 for 76-77 per cent. strength. Soda crystals are steady and in moderate request at £5 5s. per ton. Bleaching powder is rather quiet, but there is no alteration in price, which remains at £9 10s. per ton. Prussiate of soda is selling slowly at 3¾d. to 4d. per lb. Alkali is firm at £6 15s. per ton and a fair volume of business is being put through. Chlorate of soda is rather a firm section at 2⅝d. to 2⅞d. per lb. Acetate of soda is in quiet demand at £19 10s. to £20 per ton. Phosphate of soda is not attracting very much attention, though at £12 15s. per ton prices are about the same as at last report. Bichromate of soda is maintained at 4d. per lb. and a quietly steady trade is being done. Bicarbonate of soda is quiet but unchanged at £10 10s. per ton.

Among potash compounds, both caustic and carbonate, although only called for in moderate quantities, keep steady. Caustic is offering at about £30 per ton and carbonate at £24 10s. to £25. Bichromate of potash is maintained at its recent level of 5d. per lb., with demand on a small scale. Chlorate of potash is in fair inquiry and values are firm, about 3¼d. per lb. now being quoted. Permanganate of potash keeps steady at from 6½d. per lb. for commercial quality to 7½d. for B.P. Prussiate of potash is rather quiet with values steady at round 7d. per lb.

Arsenic still meets with a very restricted demand and no improvement in values can be reported, although, at the same time, little further weakening since last week has occurred; white powdered, Cornish makes, is on offer in Manchester at about £29 per ton. Commercial Epsom salts are quiet but unchanged at £4 10s. to £4 15s. per ton, with magnesium sulphate, B.P. quality, offering at round £6. Acetate of lime is in limited request but prices are steady at £14 10s. to £15 per ton for grey and £9 10s. for brown. Sulphate of copper is still quoted at £24 10s. to £25 per ton, but business is far from brisk. Nitrate of lead is about unchanged at £41 10s. to £42 per ton. Acetate of lead is on offer at £45 for white and £41 10s. per ton for brown material.

Acids and Tar Products

Acetic acid is in quiet demand and quotations are fairly steady at £40 per ton for 80 per cent. commercial quality and £67 to £68 for glacial. Oxalic acid is not attracting much attention at 3¾d. per lb. Tartaric acid is quiet at 11¾d. to 1s. per lb., with citric on offer at 1s. 4d. to 1s. 4½d.

Generally speaking, there has been little improvement in the position of coal-tar products. Pitch keeps inactive at round 40s. per ton. There is still little movement in carbolic acid and values are weak; crystals are quoted at about 5d. per lb. and crude at 1s. 7d. per gallon. Naphthalenes are quiet but unchanged at £15 per ton for refined and £4 15s. and upwards for crude qualities. Solvent naphtha is in moderate request at 1s. 5½d. per gallon.

Company News

Canada Cement Co.—A quarterly dividend of $1½ per share is announced on the ordinary stock.

American Smelting and Refining Co.—A dividend of $1½ per share has been declared on the common stock for the quarter, payable on May 1.

Hadfields, Ltd.—The directors recommend a dividend for the year on the ordinary shares of 2½ per cent., less tax, against 4 per cent. for the previous year.

Eastman Kodak Co. of New Jersey.—The net profits for 1924 totalled $17,201,815. Dividends amounting to 8 per cent. were paid on the common stock, leaving $564,473, and bringing the total surplus at December 31, 1924, to $66,523,113.

Tarslag Co.—The accounts for the eighteen months ending December 31, 1924, show a net profit, after providing for loss on road laying contracts, of £33,849. It is proposed to pay the dividend on the preference shares, to add £12,813 to the depreciation fund, and to carry forward the remaining £3,416.

Team By-Product Coke.—For the year ended November 30, 1924, the company's operations, after providing for taxation, show a loss of £40,107, from which must be deducted the balance brought forward £9,293, leaving a debit balance to be carried forward of £30,814. The annual meeting will be held at Newcastle-on-Tyne on April 29.

Magadi Soda Co.—The statutory report states that the number of shares allotted is 905,514, being 100,000 ordinary shares of £1 each, 717,814 six per cent. second preference shares of 5s. each, and 87,700 twelve and a-half per cent. preferred ordinary shares of 5s. each. There are allotted 717,814 shares as fully-paid in part satisfaction of the consideration payable under the agreement for the purchase by the company of the undertaking and assets of the Magadi Soda Co., in compulsory liquidation. The statement of receipts and payments to April 6 shows cash at bank amounting to £24,914. The preliminary expenses are estimated to amount to £23,270.

Oil Shale in Estonia

A paper on "The Present Status of the Oil Shale Industry in Estonia" was given by Mr. P. N. Kogerman, F.C.S., before the Institution of Petroleum Technologists in London on Thursday.

The paper first dealt with the history of the local oil shale known as "Kukersite," and traced the development from its discovery near Kohala, some 135 years ago, to its present exploitation by the State. The geological structure and properties of the shale were touched upon and its chemical composition outlined. The shale is one of the richest known and has attracted the at ention of several foreign countries. The author then described the distillation of "Kukersite" for the production of oil and gave details of laboratory experiments with the shale carried out by himself at the Imperial College, Kensington. Reference was also made to the experimental distillation on a commercial scale carried out at the Kohtla distillation plant. The Kohtla crude oil is used at present mainly as fuel oil, fractionation being only carried out on a limited scale. The light oil obtained by steam distillation at 100° C. is suitable for motor-cars. The next fraction, up to 280-300° C., is "motor-oil" for oil engines, and the residue is a pitch, "shale asphalt" of high quality.

India's Chemical Imports

India's total import trade during the nine months ending December, 1924, in respect of dyes obtained from coal tar rose from Rs. 171½ lakhs to Rs. 204½ lakhs, the largest proportion coming from Germany, whose share was valued at Rs. 155 lakhs. Imports from Netherlands were valued at Rs. 19 lakhs, and Belgium Rs. 14½ lakhs. The share of the United Kingdom in this trade again fell from Rs. 18½ lakhs to nearly Rs. 5½ lakhs. Imports of paints and colours from the United Kingdom declined by Rs. 4 lakhs to Rs. 55 lakhs. Germany increased her share to Rs. 6 lakhs. Soap figures in respect of trade with the United Kingdom showed an increase of Rs. 13½ lakhs, all compared with the corresponding period of 1923.

Tariff Changes

AUSTRALIA.—The new preference conditions include the following statement. "The following list indicates the goods which for Preference purposes will be deemed to be goods of a class or kind not commercially manufactured in Australia. Subject to compliance with the general conditions governing preference such goods will be admitted at the rates of the British Preferential Tariff if United Kingdom labour and/or material represent not less than 25 per cent. of the factory or works cost of each article in its finished state. Colours and Dyes—London Purple, Paris Green, Ceramic colours, vandykes, manganese, vermilions and prepared glazes for pottery, in dry colour form; artists' colours (except liquid drawing inks); dyes, dry or in paste form for manufacturing purposes.

"Salicylic acid and other food preservatives; salicylate of soda; Maltopeptone yeast food, yeast food preservatives, yeast nourishment, Quillaya bark, Saponarias, Glycyrrhizin and its compounds. Boric acid. Saccharin. Medicines and other preparations classifiable under Tariff Item 285 (c). Emery, oil and whet stones, asbestos."

NEW ZEALAND.—An Order exempts agar-agar imported from the payment of Customs duty, with effect from February 12, 1925.

UNION OF S. AFRICA.—The following rates now obtain, the figures in parentheses representing the rebate on U.K. goods. White lead: Dry, 7s. per 100 lb. (1s. per 100 lb.); Ground in oil: In packages containing 50 lb. or over, 10s. per 100 lb. (1s. per 100 lb.); in packages containing under 50 lb., 11s. per 100 lb. (1s. per 100 lb.).

Disinfectants in bulk are now rated at 5 per cent. *ad valorem*, and baking powder at 8d. per lb.

GREECE.—Flour imported into Greece must now conform to these conditions.—First quality flour must contain not more than 0·12 per cent. acidity in sulphuric acid, not less than 26 per cent. wet gluten, not more than 0·60 per cent. ash, and not more than 13·5 per cent. moisture; and must have a reasonable flavour. Second quality flour must contain not more than 0·15 per cent. acidity in sulphuric acid, not less than 28 per cent. wet gluten, not more than 1 per cent. ash, and not more than 13·5 per cent. moisture; and must have a reasonable flavour.

ROUMANIA.—The export of "Decapon" and Degras, and other similar preparations for tanning leather; typographic ink; colours and lacquers which are manufactured in the country is now taxed at the rate of 5 lei per 100 kilogs.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

CHEMICALS.—An agent in Budapest wishes to represent British manufacturers of chemicals, pharmaceutical preparations and drugs. Correspondence in English. (Reference No. 446.)

HEAVY CHEMICALS, ETC.—A firm of commission agents in Riga desires to represent British manufacturers of heavy chemicals (especially for the glass, paper, and leather industries). (Reference No. 447.)

CHEMICALS.—A firm of commission agents in Warsaw desires to represent British exporters of heavy and other chemicals. (Reference No. 485.)

COAL-TAR PRODUCTS.—A firm of commission agents at Amsterdam desires to represent British manufacturers of coal tar, pitch, creosote, pyridine, etc. Correspondence in English. (Reference No. 480.)

SOAP.—An Indian firm of merchants and manufacturers' agents in Bombay is open to consider additional representation for soap. (Reference No. 451.)

ARTIFICIAL SILK.—A British commission agent in Lisbon wishes to secure an agency for artificial silk. (Reference No. 488.)

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[*NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry make no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

LEONARD'S MANUFACTURING CHEMISTS, LTD., 144, Albany Street, N.W. (C.C., 25/4/25.) £15 9s. 4d. January 3.

Receivership

WILD AND BARROW, LTD. (R., 25/4/25.) C. V. Jarvis, of 9, St. Mary's Street, Deansgate, Manchester, was appointed receiver on April 3, 1925, under powers contained in mortgage debenture dated September 4, 1924.

Mortgages and Charges

[***NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.***]

BAILES (ARTHUR T.), LTD., Bradford, chemists. (M., 25/4/25.) Registered April 7, £680 and further advances mortgage, to Bradford Third Equitable Benefit Society; charged on 1252, Leeds Road, Bradford.* April 30, 1924.

London Gazette

Winding Up Petitions

COMET CHEMICAL CO., LTD. (W.U.P., 25/4/25.) A petition for winding up has been presented and is to be heard at the Royal Courts of Justice, Strand, London, May 5.

SHARDLOW CHEMICAL CO., LTD. (W.U.P., 25/4/25.) A petition for winding up has been presented and is to be heard at the Court House, St. Petersgate, Nottingham, on Thursday, April 30, at 12.30 p.m.

Partnership Dissolved

SOUTHALL COLOUR AND CHEMICAL CO. (Thomas BARKER and Harold Stephen ADDIS), Marlow Road, Southall, Middlesex, colour and chemical manufacturers, and merchants, by mutual consent as from December 31, 1924. Debts received and paid by T. Barker who will continue the business.

New Companies Registered

NAYLOR BROTHERS (SCOTLAND), LTD., Wexham Road, Slough, Bucks. Dealers in varnishes, paints, etc. Nominal capital, £3,000 in £1 shares.

ROBINSON AND WORDSWORTH (1925), LTD., 28, Corporation Street, Birmingham. Liquorice cake manufacturers. Nominal capital, £5,000 in £1 shares (1,000 5 per cent. cumulative preference and 4,000 ordinary).

Exciting Incident to Dr. C. A. Keane

AN exciting incident is reported respecting Dr. C. A. Keane, principal of the Sir John Cass Institute, London. On the arrival at Plymouth on Monday of the Union Castle liner *Grantully Castle* from East and South Africa it was reported that during the outward voyage, about 600 miles from Cape Town, a passenger noticed something pass the port hole of his cabin. An alarm was given, lifebuoys were put over the ship's side, and the liner turned round. It was found that Dr. Keane, who, it is understood, was on a health trip to Beira, Portuguese East Africa, was overboard. How he got into the water is not known. He kept afloat until picked up by a lifeboat lowered from the liner.